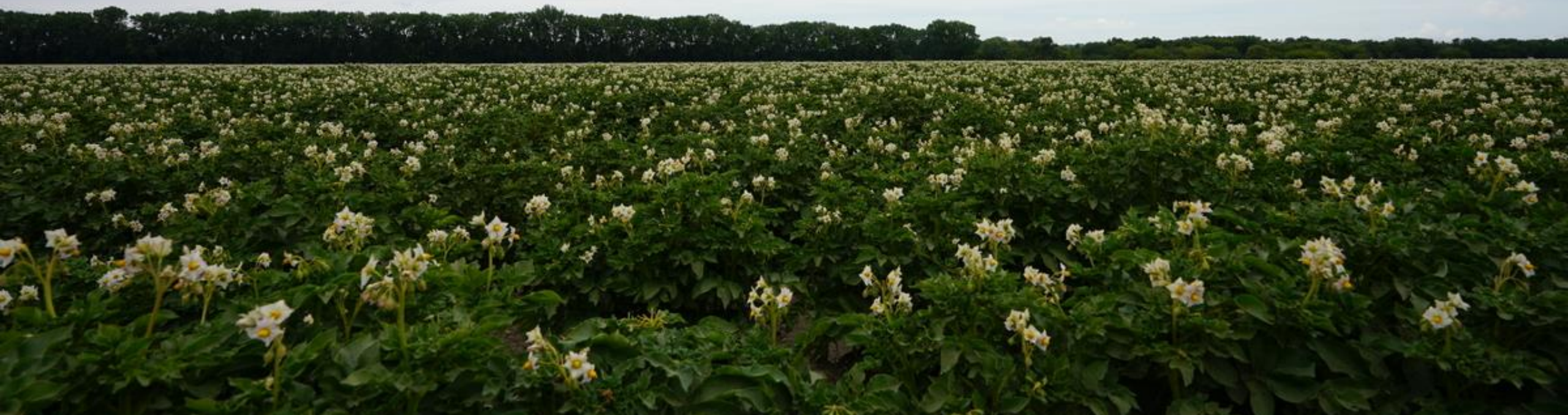
Weed Control in Potatoes

Andy Robinson
Extension Agronomist – Potatoes
NDSU/U of M

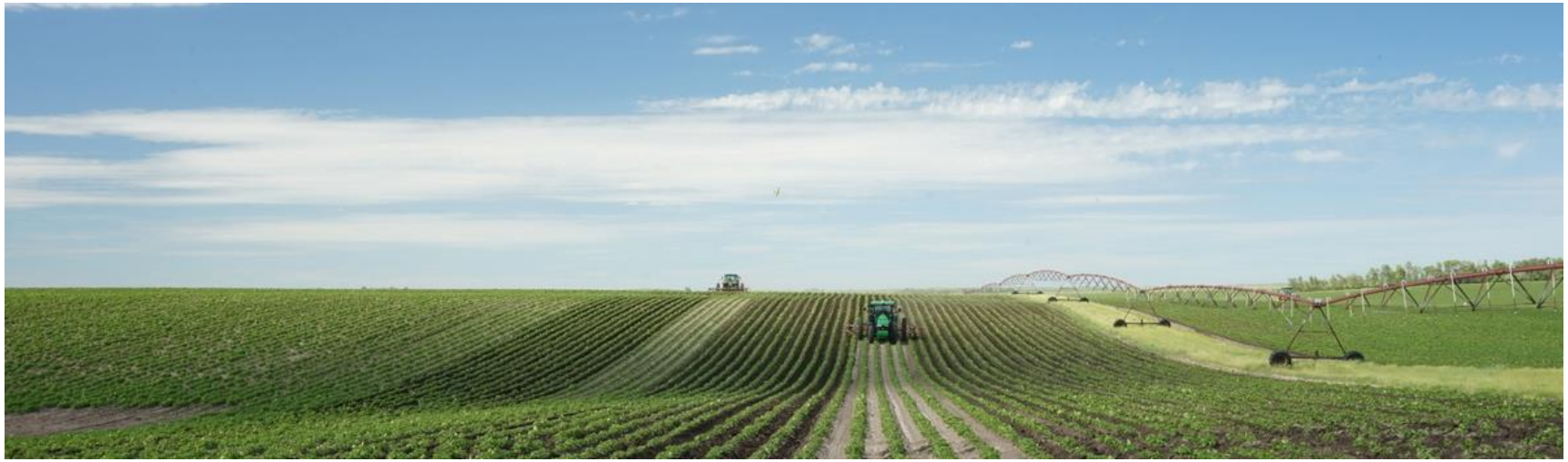


Weeds

- Weeds can cause >73% yield loss in potato.
- Potatoes are a good example of IPM (for weed control and managing resistance)

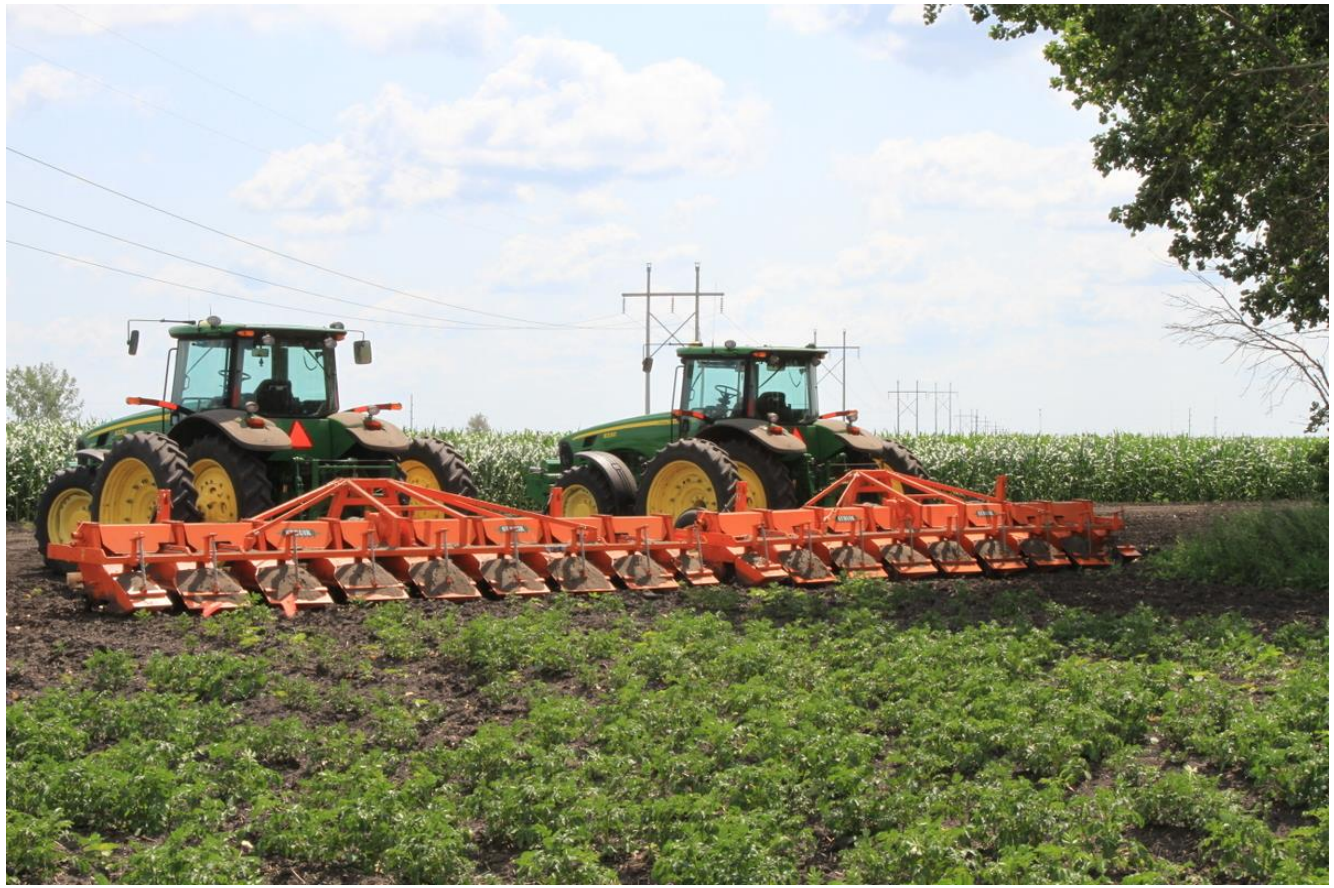
Integrated Pest Management

Integrated Weed Management is defined as the use of a range of control techniques, embracing physical, chemical and biological methods in an integrated fashion without excessive reliance on any one method (Powles and Matthews, 1992).



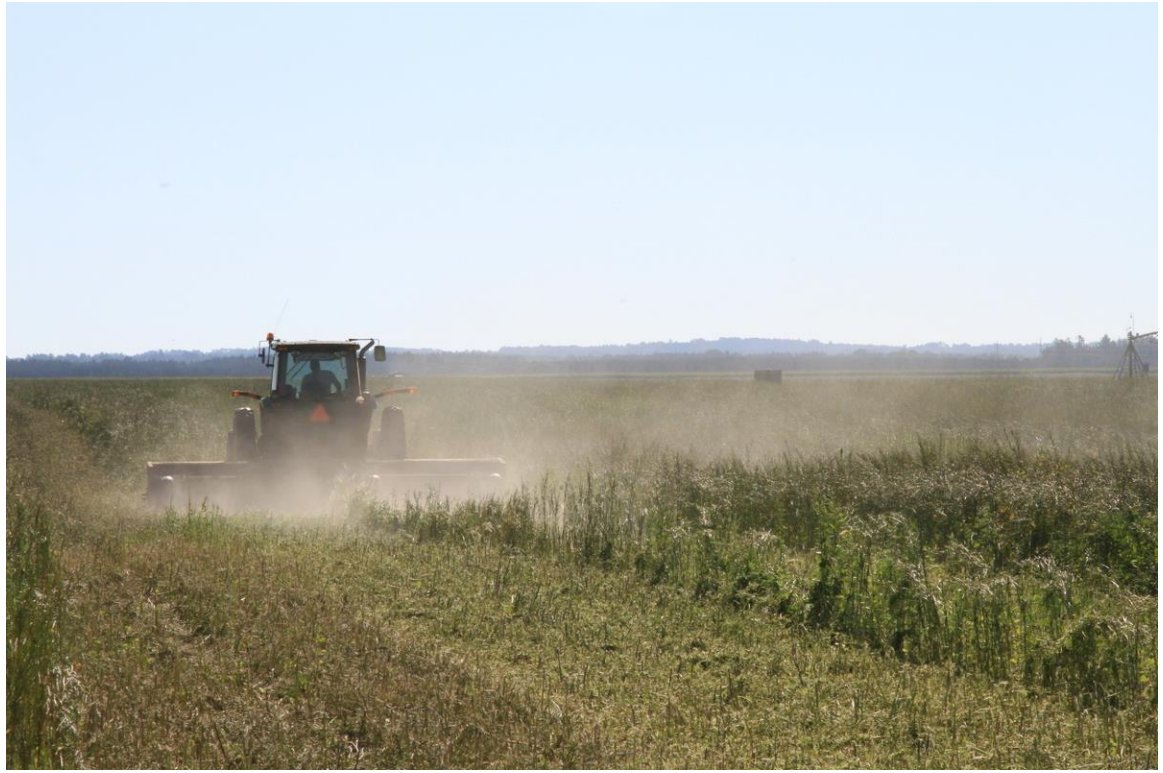
Weed control methods

- Prevention
- Cultural
- Mechanical / physical
- Chemical
- Biological



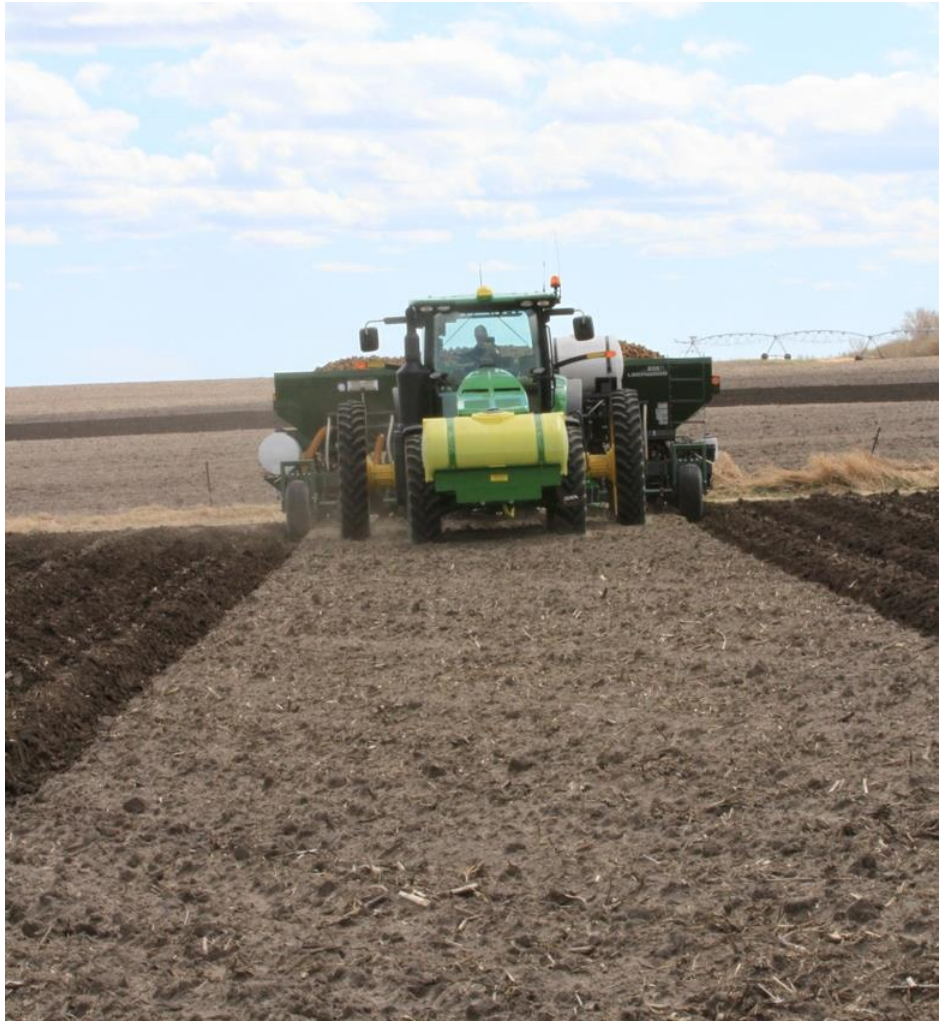
Prevention and cultural management

- Crop rotation
- Planting configuration
- Removing debris and soil from equipment
- Proper watering and fertilizing of crop
- Growing competitive plants



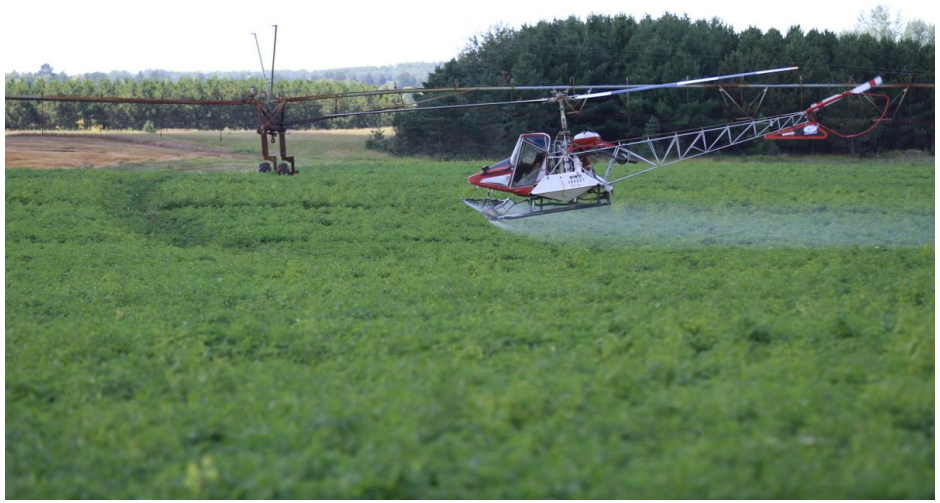
Mechanical and physical weed control

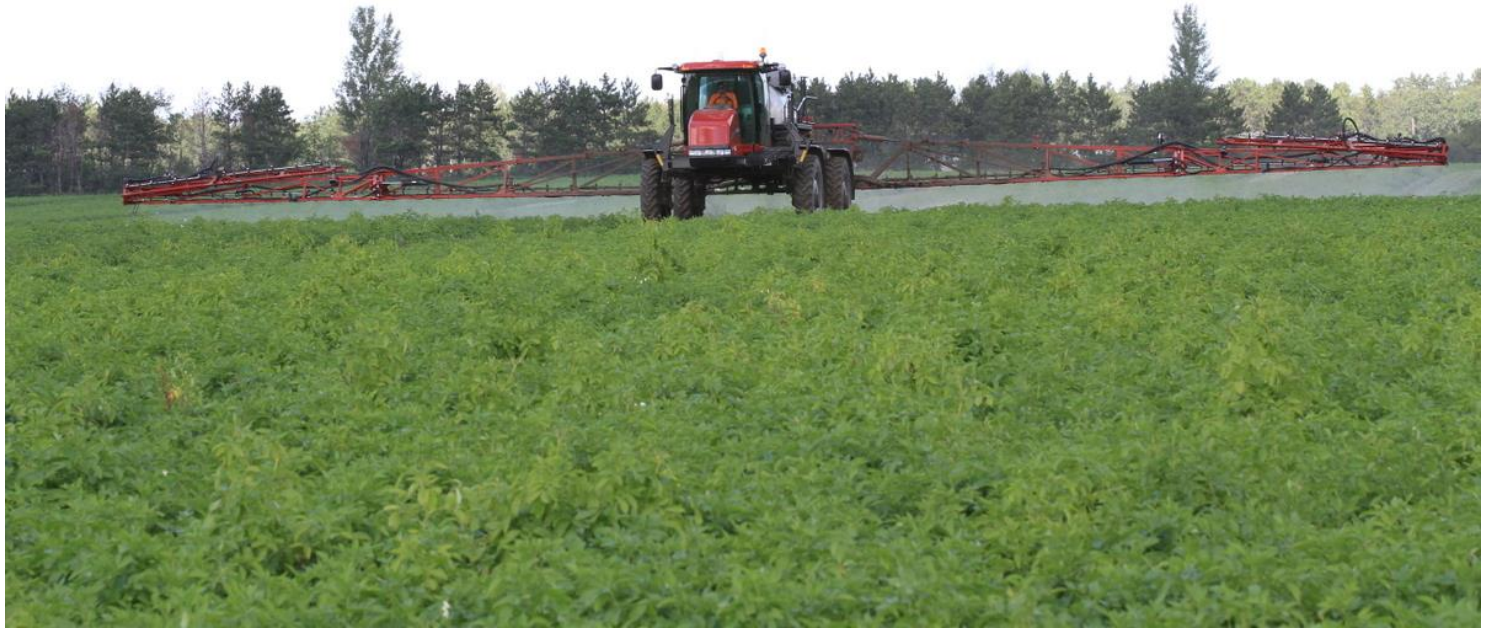
- Tillage / hilling
  - Remove emerging weeds
  - Reshape hill
  - Incorporate herbicides
- Hand weeding
  - Kills all weeds – no resistance to this method



Chemical weed control

- Herbicides





Preemergence modes of action

Mode of Action	Group	Herbicide(s)	Year reported or registered
Lipid synthesis inhibition	1 / A	clethodim / Select sethoxydim / Poast	1987 1978
ALS inhibitors	2 / B	rimsulfuron / Matrix	1992
PS II inhibitors	5 / C1, C2	metribuzin / Sencor linuron / Linex	1964 1962
PPO inhibitors	14 / E	flumioxazin / Chateau fomesafen / Reflex Sulfentrazone / Sulfentrazone 4SC	1989 1983 1998
Microtubule assembly inhibition	3 / K1	trifluralin / Treflan ethalfluralin / Sonalan pendimethalin / Prowl	1960 1974 1974
Thiocarbamates	8 / N	EPTC / Eptam	1957
Inhibition of VLCFAs	15 / K3	dimethenamid / Outlook metolachlor / Dual	1993 1972
Lipid synthesis inhibition	8 / N	EPTC / Eptam	1957

Postemergence modes of action

Mode of Action	Group	Herbicide(s)
Lipid synthesis inhibition	1 / A	clethodim / Select sethoxydim / Poast
ALS inhibitors	2 / B	rimsulfuron / Matrix
PS II inhibitors	5 / C1, C2	metribuzin / Sencor
Microtubule assembly inhibition	3 / K1	pendimethalin / Prowl
Inhibition of VLCFAs	15 / K3	metolachlor / Dual
Lipid synthesis inhibition	8 / N	EPTC / Eptam

Selection herbicides

- Variety sensitivity
  - Minituber/NFT sensitivity
- Weed spectrum
- Timing
- Cost of herbicide and application
- Rotation restrictions

Tips for maximum efficacy

- Incorporate (tillage or water)
- Timing
  - PRE: prior to emergence (follow label)
  - POST: small weeds, <1 inch tall is ideal
- Use adjuvants with POST herbicides
- Tank mix herbicides to improve weed control spectrum

Timing of herbicides

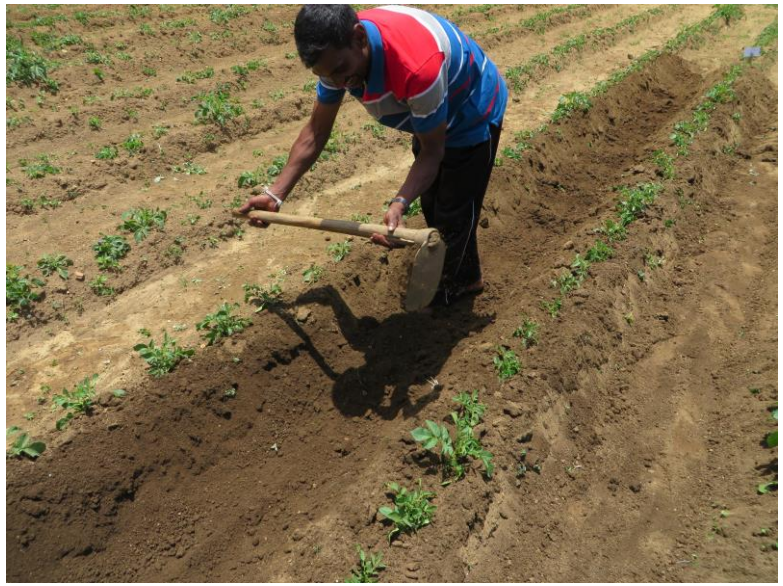
- 3 – 5 week window for PREs
- Program could include:
  - Tillage / field preparation
  - Planting
  - Hilling
  - Herbicide prior to emergence
  - Postemergence herbicide

Preemergence modes of action

Mode of Action	Group	Herbicide(s)	Year reported or registered	Water solubility (mg/L)	Half life (days)
Lipid synthesis inhibition	1 / A	clethodim / Select sethoxydim / Poast	1987 1978	- 257	- -
ALS inhibitors	2 / B	rimsulfuron / Matrix	1992	<10	3
Microtubule assembly inhibition	3 / K1	trifluralin / Treflan ethalfluralin / Sonalan pendimethalin / Prowl	1960 1974 1974	0.3 0.3 0.3	164 34 44
Lipid synthesis inhibition	8 / N	EPTC / Eptam	1957	370	9
PS II inhibitors	5 / C1 C2	metribuzin / Sencor linuron / Linex	1964 1962	1100 75	21 60
PPO inhibitors	14 / E	flumioxazin / Chateau fomesafen / Reflex Sulfentrazone	1989 1983 1998	2 50 780	15 100 211
Inhibition of VLCFAs	15 / K3	dimethenamid / Outlook metolachlor / Dual	1993 1972	1174 488	20 40

How to optimize weed control?

- Use an integrated weed management approach with many tools.
  - Tillage
  - Best herbicides at right time
  - Cultural management practices
  - Do not encourage herbicide resistance



Microtuber (G1) weed control (2018 data)

Treatment	< 2 oz	2-4 oz	4-6 oz	6-8 oz	> 8 oz	Total
	---------- cwt/a ----------					
Russet Burbank	12	60 a	62 ab	49	55	237 a
Russet Burbank + Zidua	9	61 a	67 a	42	37	217 abc
Umatilla	7	37 b	54 bc	50	76	223 ab
Umatilla + Zidua	6	50 a	51 bcd	45	91	243 a
Clearwater	9	30 b	41 d	44	55	179 bc
Clearwater + Zidua	10	36 b	44 cd	32	27	150 c

Tank mix study: crop injury, weed efficacy

Estimated visual rating of crop injury of Umatilla Russet and Russet Burbank. Weed control ratings of red root pigweed, common lambsquarters, hairy nightshade and Eastern black nightshade at 1, 2 and 4 weeks after emergence at Hubbard, MN 2018.

Treatment		Umatilla Russet			Russet Burbank			Red Root Pigweed			Hairy Nightshade			Common Lambsquarters		
		Crop injury (%)			Crop injury (%)			Efficacy (%)			Efficacy (%)			Efficacy (%)		
		6/8	6/19	7/6	6/8	6/19	7/6	6/8	6/19	7/6	6/8	6/19	7/6	6/8	6/19	7/6
1	Non-treated check	100	100	100	100	100	100	0	0	0	0	0	0	0	0	0
2	Zidua 3.5 oz/a + Metribuzin 0.5 lb/a	95	100	100	98	100	100	100	75	100	100	100	100	95	75	85
3	Zidua 3.5 oz/a + Dual 1 pt/a	98	100	100	100	100	100	98	98	75	100	100	100	98	100	100
4	Sulfentrazone 3 oz/a	95	100	100	95	100	100	93	75	75	100	75	80	93	75	80
5	Zidua 3.5 oz/a + metribuzin 0.5 lb/a + Dual 1 pt/a = Matrix 1.5 oz/a	96	100	100	100	100	100	100	100	100	100	100	100	100	100	100
6	Zidua 3.5 oz/a + Metribuzin 0.5 lb/a	97	100	100	100	100	100	100	100	100	100	100	100	100	100	88
7	Metribuzin 0.5 lb/a + Dual 1 pt/a + Sulfentrazone 3 oz/a	92	100	100	97	100	100	96	100	100	96	100	100	96	98	90
Mean		96	100	100	98	100	100	84	78	79	85	82	83	83	78	78
CV		4	-	-	3	-	-	8	34	34	3	23	18	9	34	29
LSD p=0.05		ns	-	-	ns	-	-	10	39	39	4	28	22	11	39	33
LSD p=0.10		4	-	-	ns	-	-	8	33	33	3	23	18	9	33	27

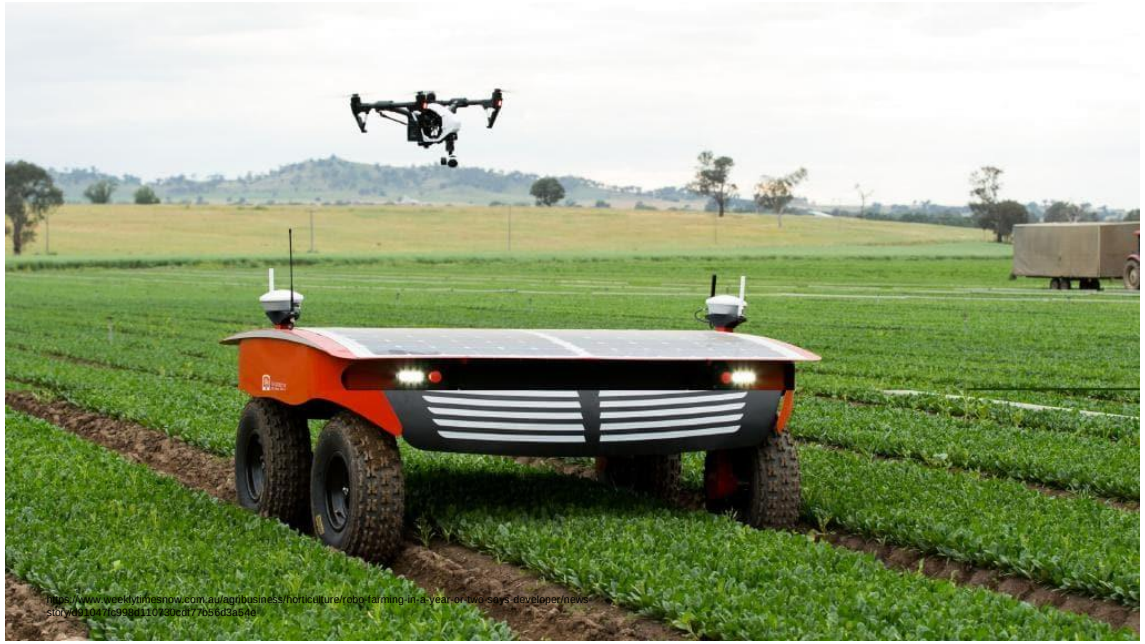
Tank mix study graded yield – Russet Burbank

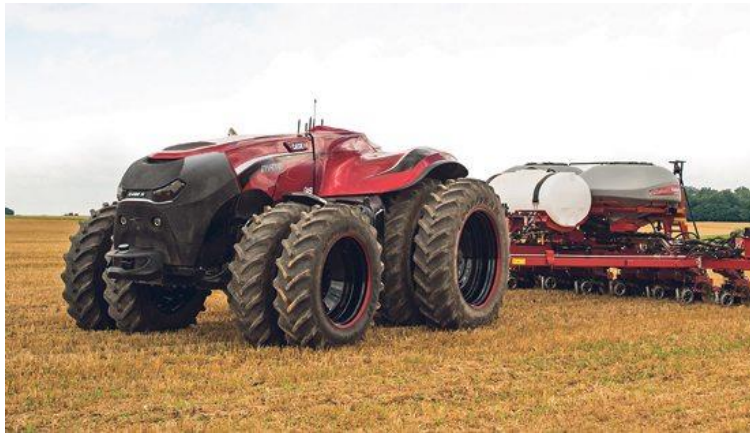
Treatment		<4 oz	4-6 oz	6-10 oz	10-14 oz	>14 oz	Total yield	Total Marketable	US#1 >4 oz	US#2 >4 oz	>6 oz	>10 oz
		cwt/a									%	
1	Non-treated check	127	178	162	21	11	500	373	358	14	38	6
2	Zidua 3.5 oz/a + Metribuzin 0.5 lb/a	176	197	158	22	5	558	382	369	13	33	5
3	Zidua 3.5 oz/a + Dual 1 pt/a	161	179	128	25	2	495	334	318	16	31	5
4	Sulfentrazone 3 oz/a	137	171	172	50	12	542	404	386	18	42	11
5	Zidua 3.5 oz/a + Metribuzin 0.5 lb/a + Dual 1 pt/a = Matrix 1.5 oz/a	137	183	165	50	12	547	410	392	19	41	11
6	Zidua 3.5 oz/a + Metribuzin 0.5 lb/a	192	219	119	16	0	546	355	345	9	25	3
7	Metribuzin 0.5 lb/a + Dual 1 pt/a + Sulfentrazone 3 oz/a	153	185	172	41	9	560	408	387	20	39	8
Mean		155	187	154	32	7	535	381	365	16	36	7
CV		17	13	23	89	109	10	14	13	69	25	79
LSD p=0.05		ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
LSD p=0.10		ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns

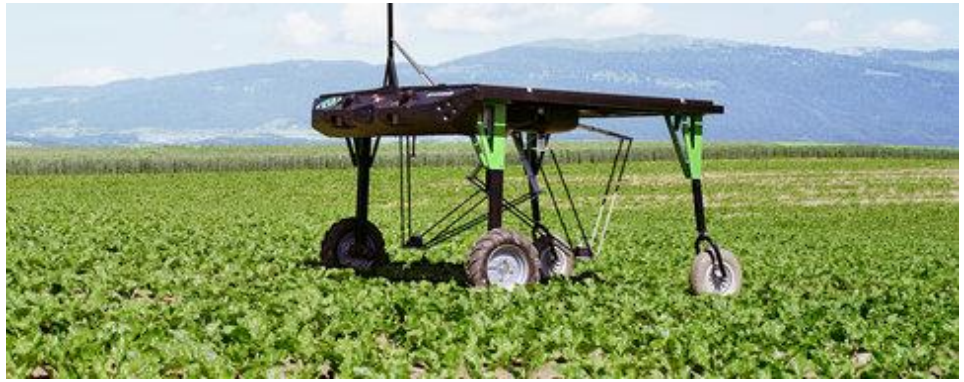
Tank mix study graded yield – Umatilla Russet

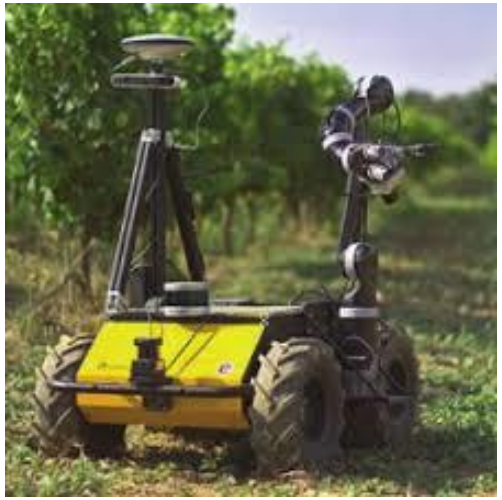
Treatment		<4 oz	4-6 oz	6-10 oz	10-14 oz	>14 oz	Total yield	Total Marketable	US#1 >4 oz	US#2 >4 oz	>6 oz	>10 oz
		cwt/a									%	
1	Non-treated check	87	166	173	71	38	535	448	424	23	53	20
2	Zidua 3.5 oz/a + Metribuzin 0.5 lb/a	98	143	228	71	29	569	471	443	28	57	18
3	Zidua 3.5 oz/a + Dual 1 pt/a	97	154	175	51	27	505	407	380	28	50	15
4	Sulfentrazone 3 oz/a	85	154	169	42	24	474	389	366	24	48	14
5	Zidua 3.5 oz/a + Metribuzin 0.5 lb/a + Dual 1 pt/a = Matrix 1.5 oz/a	87	141	205	80	42	554	468	430	38	59	21
6	Zidua 3.5 oz/a + Metribuzin 0.5 lb/a	98	132	209	77	19	534	436	424	12	56	17
7	Metribuzin 0.5 lb/a + Dual 1 pt/a + Sulfentrazone 3 oz/a	123	164	193	64	29	573	450	426	23	49	15
Mean		97	151	193	65	30	535	438	413	25	53	17
CV		28	20	25	49	76	17	21	21	52	19	41
LSD p=0.05		*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*
LSD p=0.10		*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*

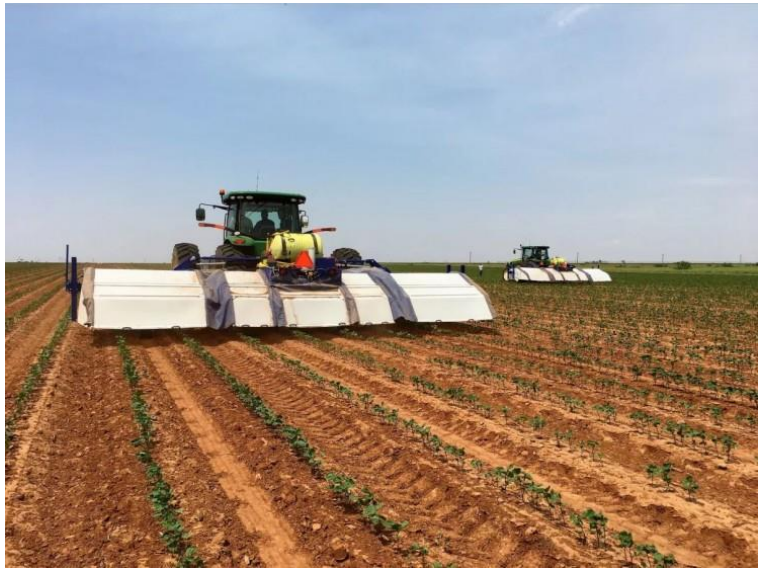
Future of weed control…







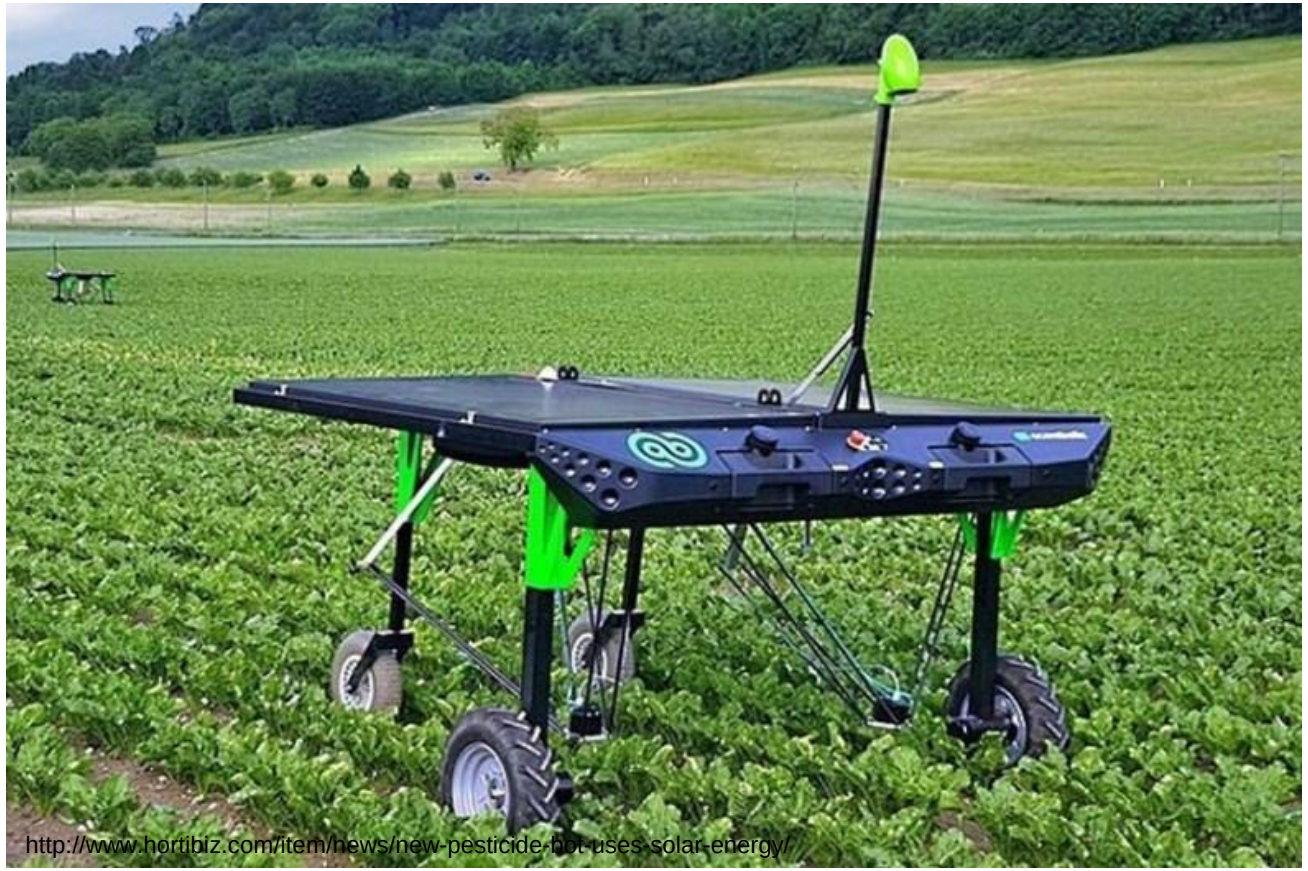




New tools – help to manage resistance

- Robotic weed control

- Video



http://www.hortibiz.com/item/news/new-pesticide-hot-uses-solar-energy/

Take home message

Use in integrated pest management plan to control weeds and prevent herbicide resistant-weeds.

Thank you!