

Kochia and its Management

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Kochia

Kochia scoparia L.

- Annual
- Native of central Eurasia
 - Arid to semiarid climate
- Introduced to North America as an ornamental hedge & forage of saline areas
- Nutritive value similar to alfalfa



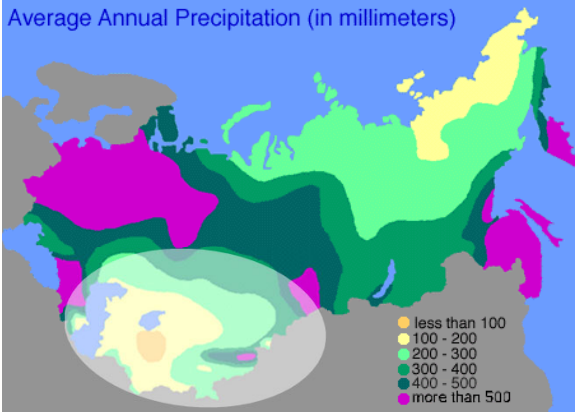


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Kochia Origins

Kochia scoparia L.

Average Annual Precipitation (in millimeters)



● less than 100
● 100 - 200
● 200 - 300
● 300 - 400
● 400 - 500
● more than 500

25mm = 1"

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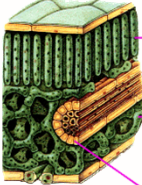
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Kochia

Kochia scoparia L.

- Kochia is a C₄ plant
 - Grows more efficiently in hot, dry weather
 - Able to convert low CO₂ levels to sugars more efficiently
 - Able to store CO₂ at night to use through the day
 - Other C₄ plants are corn, millets, barnyard grass, pigweeds, & lamb's-quarters
- Most prairie crops are C₃ plants
 - Grow more efficiently in cool, moist, short-season conditions

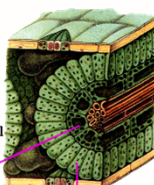
C₃ Leaf



palisade mesophyll

bundle sheath cell

C₄ Leaf

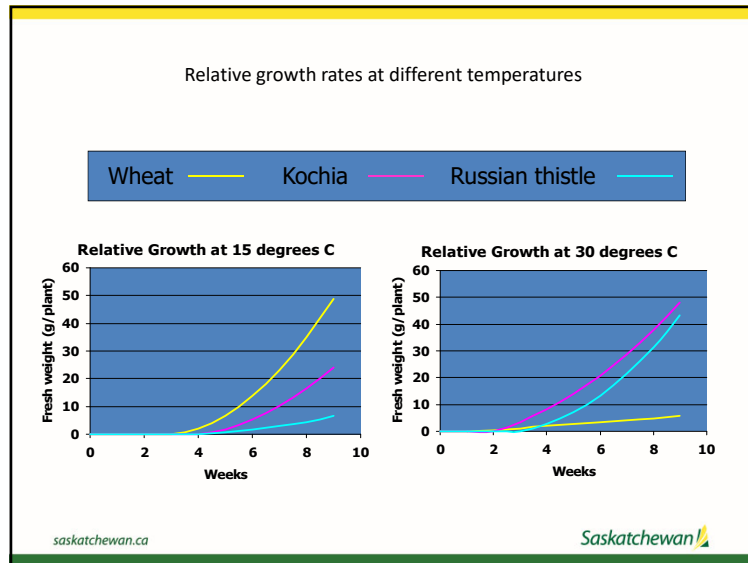


spongy mesophyll

mesophyll

From: University of Wisconsin – Tree Physiology

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Kochia

- Tolerant of saline & dry soils
 - Seed and root can draw needed water from soil under lower available water conditions than other plants
 - germinate & grow where others can't
 - Will grow in conditions too dry to activate soil applied herbicides
- Well adapted to hot & dry conditions
 - Deep greatly branched tap root
 - Kochia plant is covered with dense hair to slow moisture loss from leaves

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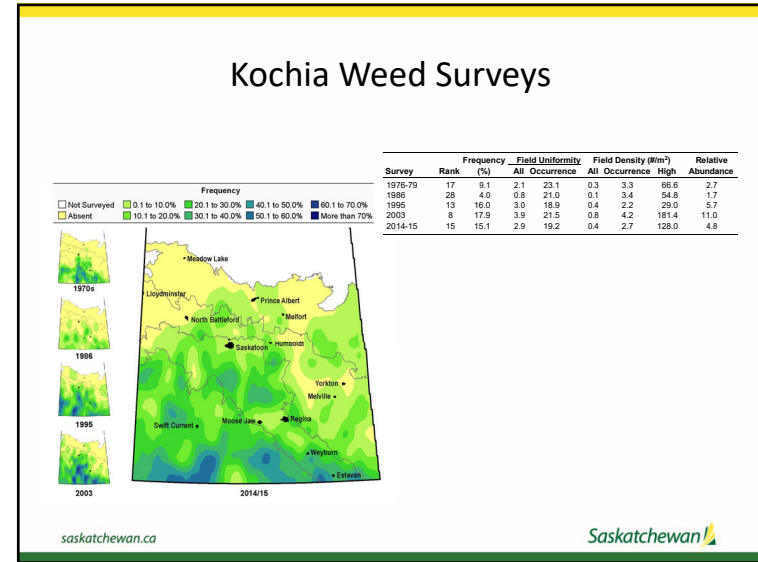
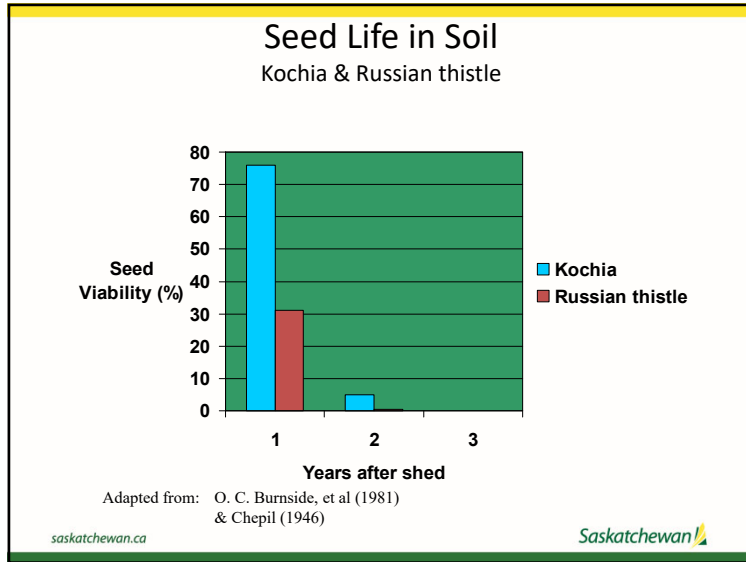
Tumbleweeds

Kochia

Seeds

- Annual plant reproduces only by seed
- Heavy seed producer
 - Avg. ~14,000-15,000 per plant
 - Max ~ 30,000 per plant
- Seeds small - 1/16" long
- Seed germinates over a wide range of conditions (4-40 ° C)
- Short life in soil
- Plant tumbles to disperse seeds

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Kochia Populations

Herbicide Resistance

Year	Grp 2 - Res samples	Susceptible samples	Poor Seed Quality	Total Samples
1996	5	0	0	5
1997	7	0	3	10
1998	6	0	4	10
1999	2	0	2	4
2000	1	0	0	1
2001	0	0	1	1
2002	11	0	0	11
2003	6	0	1	7
2004	3	0	0	3
Totals	41	0	11	52

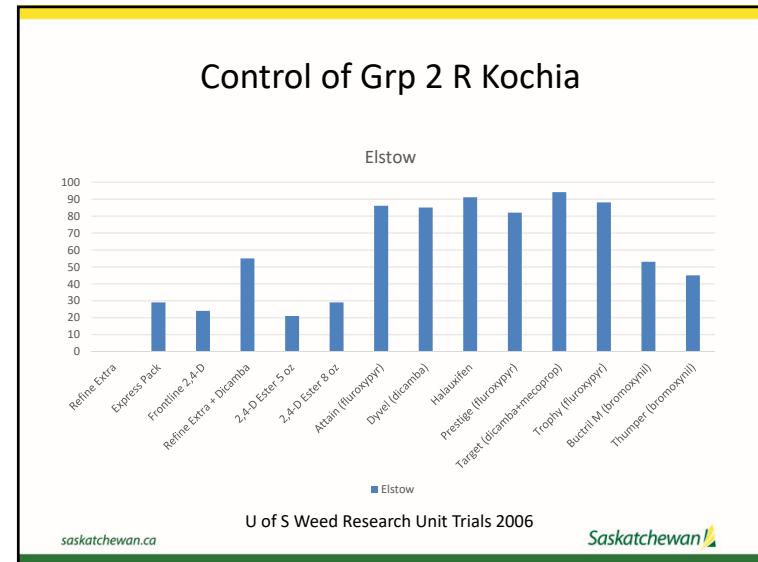
Tested with Refine Extra

Adapted from Beckie and Brenzil 2003

- Good sampling is important to get a good answer
- If you think you might have Group 2 resistant kochia....

YOU LIKELY DO!

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Kochia

Chemical Controls

Group 2*

- **Cereals:**
 - thifensulfuron+tribenuron
 - Tribenuron
 - Metsulfuron
 - Florasulam
 - Pyroxulam
 - Thiencarbazone
- **Peas & Clearfield Canola:**
 - Imazamox
 - Imazamox+imazethapyr
 - Imazethapyr
 - Imazapyr
- **Fallow, preseed:**
 - Florasulam
 - Tribenuron

* Herbicide resistance has been reported in these groups.
Also resistance to atrazine in corn in USA.

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Group 3

- **Broadleaf crops:**
 - Ethalfuralin (*Edge*)

Group 4*

- **Cereals:**
 - dicamba,
 - dichlorprop/2,4-D,
 - fluroxypyr,
 - halauxifen (*Arylex*)
- **Fallow/burn-off:**
 - Dicamba
 - Dicamba+diflufenzopyr (19)
 - halauxifen

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Chemical Controls

Group 6

- **Cereals:**
 - Bromoxynil + MCPA
 - Bromoxynil + 2,4-D
- **Flax:**
 - Bromoxynil (with and without MCPA)

Group 9*

- **RR canola, preseed, pre-harvest & Fallow:**
 - Glyphosate

Group 10

- **LL canola:**
 - Glufosinate (*Liberty* and others)

Group 14

- **Burnoff/Fallow:**
 - Carfentrazone (*Aim*)
 - pyraflufen (*Blackhawk, Goldwing*)
 - saflufenacil (*Heat*)
- **Pre-emergent (pulses, cereals, and other crops) – all products not all for all crops:**
 - Flumioxazin (*Valtera* & others)
 - Sulfentrazone (*Authority* & others)

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Chemical Controls

Group 15

- **Cereals, pulses (not all):**
 - Pyroxasulfone (*Focus, Zidua, and combos*) – suppression only

Group 27*

- **Cereals:**
 - Pyrasulfotole (*Infinity* and others)

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- Utilize shelterbelts or other structures to:
 - Reduce wind speed over infested land
 - Act as a barrier to new infestations



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Improving the effectiveness of Herbicides:

- Use highest recommended water volumes and adjuvant levels
 - Plant defenses used to prevent moisture loss also act as barriers to herbicides
- Apply at relatively early stages
 - Plants become less susceptible as they grow
- Scout ~ 3 to 4 weeks after application to assess control
 - Catch potentially resistant plants and remove before patches increase in size or tumble
 - Resistance is indicated when kochia appears unaffected and other susceptible weeds are controlled or some plants die and other don't.
- Use cultural methods to reduce reliance on herbicide alone
 - Early seeding, higher populations, narrow rows, etc.



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Kochia Cultural Controls

Cultural Controls

- "Tumbleweeds" do not tolerate shading
 - Shallow seeding – rapid crop emergence
 - Early cool-soil seeding
 - Higher seeding rates
 - Narrow rows (reduce from 12 & 15" to 10" or less)
 - No gaps in canopy - seeding misses
- Reclaim saline areas (also helpful for foxtail barley)
 - Plant saline tolerant perennial grasses
 - (NewHy, AC Saltlander wheatgrass, Tall Fescue, etc.)
 - Plant deep rooted forages on boundaries of salt areas
 - Keep in permanent forage
- Help to prevent spread – don't till in the fall
- Target till missed strips in summer
- Mow & shred to prevent seed production and tumbling
 - particularly boundary areas for sanitation

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Tumbleweed resistance patterns

Photos Pioneer Coop AgTeam



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Mechanisms of glyphosate resistance?

- GR Kochia uses overproduction of the susceptible EPSPS enzyme
 - Glyphosate is bound to excess EPSPS enzyme and there is still lots to go around

Legend: ● Glyphosate molecule, ◐ EPSPS enzyme

Glyphosate susceptible kochia

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Glyphosate resistant kochia

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Resistance Developments in W Canada

- 2017 Kochia Resistance Surveys (Alberta)
 - 300 samples collected from a range of sites (Ag, Industrial)
 - 40% of samples collected were glyph R
 - 8% of samples were dicamba R
 - 10% of samples were three way (Glyph+dicamba+Group 2)
- 2018 Kochia Resistance Surveys (Manitoba)
 - Preliminary data suggests that 59% of kochia in MB was resistant to glyphosate
 - A full report should be available in the coming months
- 2019 Kochia Resistance Surveys (Saskatchewan)
 - Kochia was collected from many sites in SK this past fall and will be tested over the coming year

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The Great Weed Spreader!

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Harvest Weed Seed Management

- “Chaff decks” collect chaff from sieves and deposit in wheel tracks of the combine
- Works in conjunction with controlled traffic farming to concentrate chaff and weed seeds within wheel tracks
- Inter-competition on track lines
- Decay and trampling

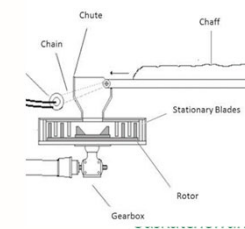
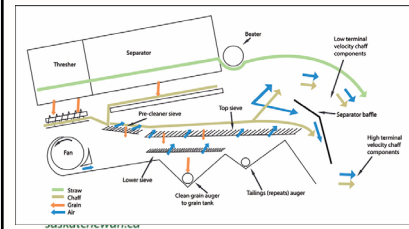
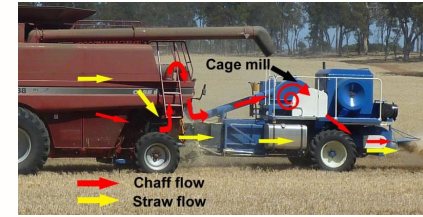


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Harvest Weed Seed Management

- Cage mills for seed destruction
 - Harrington Seed Destructor
 - Seed Terminator



HWSC Options

Integrated Harrington Seed Destructor



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www.ihsd.com

Seed Terminator



<https://www.seedterminator.com.au/>

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HWSC Options

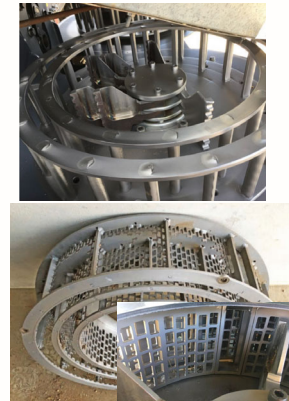
Harrington Seed Destructor



Photo: Lucerne Australia

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Seed Terminator



Photos: Kondinin Group

HWSC Options

Redekop Seed Control Unit



Photo: www.harvestweedseedcontrol.com
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Tecfarm WeedHOG



Photos: www.tecfarm.com.au
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Harvest Weed Seed Management

Redekop Seed Control Unit



Photo: www.harvestweedseedcontrol.com
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Tecfarm WeedHOG



Photos: www.tecfarm.com.au
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Harvest Weed Seed Management



Labels in image: No HSD, HSD, No HSD (10,000 canola seeds), HSD (100,000 canola seeds)

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Kochia

Concerns

- Hot dry conditions promote increase of “tumbleweeds”
- Resistance to Group 2 and Group 4 and glyphosate (Grp 9) is reducing the effectiveness of control measures for kochia
 - A high proportion of kochia samples that come to the Crop Protection Laboratory for testing are resistant - if you suspect it’s resistant it likely is.
 - USA predictor of things to come with Group 4 resistance
- Trends towards wider row spacing on seeders
 - More opportunity for seedling establishment before canopy closure
 - Makes spray work harder!
- Trends towards lower water volumes
 - Herbicides are less able to penetrate leaf defenses
 - Makes spray work harder!!

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Kochia

Resources

- Factsheet on MoA web pages
 - Control of Tumbleweeds – Managing Kochia and Russian thistle (only available online at www.saskatchewan.ca search “tumbleweeds”)
- Guide to Crop Protection 2021 – out the end of February

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Questions?

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