63 ROOT VEGETABLES

Where: Grand Gallery Overlook Room C & D
MI Recertification Credits: 2 (1B COMM CORE, PRIV CORE)
OH Recertification Credits: 1.5 (presentations as marked)
CCA Credits: CM (1) PM (1)
Moderator: Ben Phillips, Michigan State University

2:00 PM **Horseradish Production**
- Alan Walters, Southern Illinois University

2:30 PM **Lorsban Alternatives for Cabbage Maggot in Brassica Root Crops (OH 2B, 1 hr)**
- Ben Werling, Michigan State University Extension

3:00 PM **Organic and Conventional Weed Control in Red Beets (OH 2C, 0.5 hr)**
- Jed Colquhoun, University of Wisconsin

3:30 PM **Sweet Potato Production for Michigan: Can We Do It? Yes We Can!**
- Ron Goldy, Michigan State University Extension

4:00 PM **Session Ends**

Weed management in conventional and organic red beets

Jed Colquhoun, Dan Heider and Rich Rittmeyer
University of Wisconsin-Madison
Department of Horticulture

Organic or conventional, we need to think outside the box!

Weed Science

cambridge.org/wsc

Weed Management

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Investigations of 2,4-D and Multiple Herbicide Resistance in a Missouri Waterhemp (*Amaranthus tuberculatus*) Population

Lovreet S. Shergill[1], Blake R. Barlow[2], Mandy D. Bish[3] and Kevin W. Bradley[4]

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Abstract

Research was conducted from 2015 to 2017 to investigate the potential for 2,4-D and multiple herbicide resistance in a waterhemp [*Amaranthus tuberculatus* (Moq.) J. D. Sauer] population from Missouri (designated MO-Ren). In the field, visual control of the MO-Ren population with 0.56 to 4.48 kg 2,4-D ha^{-1} ranged from 26% to 77% in 2015 and from 15% to 55% in 2016. The MO-Ren population was highly resistant to chlorimuron, with visual control never exceeding 7% either year. Estimates of the 2,4-D dose required to provide 50% visual control (I_{50}) of the MO-Ren population were 1.44 kg ha^{-1} compared with only 0.47 kg 2,4-D ha^{-1} for the susceptible population. Based on comparisons to a susceptible population in dose–response experiments, the MO-Ren population was approximately 3-fold resistant to 2,4-D, and 7-, 7-, 22-, and 14-fold resistant to atrazine, fomesafen, glyphosate, and mesotrione, respectively. Dicamba and glufosinate were the only two herbicides that provided effective control of the MO-Ren population in these experiments. Examinations of multiple herbicide resistance at the individual plant level revealed that 16% of the plants of the MO-Ren population contained genes stacked for six-way herbicide resistance, and only 1% of plants were classified as resistant to a single herbicide (glyphosate). Results from these experiments confirm that the MO-Ren *A. tuberculatus* population is resistant to 2,4-D, atrazine, chlorimuron, fomesafen, glyphosate, and mesotrione, making this population the third 2,4-D–resistant *A. tuberculatus* population identified in the United States, and the first population resistant to six different herbicidal modes of action.

There aren't more herbicides on the way for beets…

AZAFENIDIN (DUPONT)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	USE CANCELED
CLETHODIM (ADAMA,ARYSTA,VALENT)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	USE REGISTERED
CLOMAZONE (FMC)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	REQUEST WITHDRAWN
CLOPYRALID (DOWAGR)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	USE REGISTERED
DESMEDIPHAM (BAYER)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	USE REGISTERED
DESMEDIPHAM + PHENMEDIPHAM (BAYER)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	USE REGISTERED
DESMEDIPHAM + PHENMEDIPHAM + ETHOFUMASATE (BAYER)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	DATA MINING PROJECT - NO PCR RECEIVED
DIETHATYL-ETHYL (BAYER)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	USE CANCELED
DIMETHENAMID-P (BASF)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	MFG WILL NOT SUPPORT
DINOSEB (NO MFG)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	USE CANCELED
ENDOTHALL (UPI)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	MFG WILL NOT SUPPORT
EPTC (GOWAN)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	REREG: USE CANCELED
ETHOFUMESATE (BAYER)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	USE REGISTERED
FLUFENACET (BAYER)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	DATA MINING PROJECT - NO PCR RECEIVED
GLYPHOSATE (ADAMA,ALBAGH,BAYER,DREXEL)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	USE REGISTERED
HERBICIDE (PRE & POST) (MANY)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	REQUEST WITHDRAWN
IMAZOSULFURON (VALENT)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	DATA MINING PROJECT - NO PCR RECEIVED
LINURON (TKI)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	DATA MINING PROJECT - NO PCR RECEIVED
METAMITRON (ADAMA,BAYER)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	DATA MINING PROJECT - NO PCR RECEIVED
PARAQUAT (AMVAC,SYNGEN)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	MFG WILL NOT SUPPORT
PENDIMETHALIN (BASF,UPI)	BEET (GARDEN) (01AB = ROOT VEGETABLES SUBGROUPS)	01AB	MFG WILL NOT SUPPORT

The IR-4 Project

Broadleaf herbicides in red beets

Pre-emergent	Post-emergent
Ro-Neet 6E	Stinger
Dual Magnum (SLN(24c), select states)	Spin-Aid
Nortron SC	Upbeet
	Nortron SC

Pesticide labels change often and vary regionally. As always, read and follow the label!

Ro-Neet 6E

Active ingredient	Cycloate
Timing	Pre-plant incorporated, mixed thoroughly in top 2-3 inches
Weed spectrum	Nightshades, common lambsquarters, common purslane, redroot pigweed, shepherdspurse, velvetleaf (suppression), some grasses, nutsedge (prior to emergence)

Pesticide labels change often and vary regionally. As always, read and follow the label!

Nortron SC

Active ingredient	Ethofumesate
Timing	Pre-emergent or post-emergent (2 to 8 leaf beets)
Weed spectrum	Wild buckwheat, common chickweed, ladysthumb and Pennsylvania smartweed, common lambsquarters, redroot pigweed, common purslane, some annual grasses

Pesticide labels change often and vary regionally. As always, read and follow the label!

Dual Magnum

Special Local Needs (24c) label in select states only

Active ingredient	S-metolachlor
Timing	Pre-emergent, 30 day pre-harvest interval
Weed spectrum	Several annual grasses, hairy galinsoga, *Amaranthus* spp., eastern black nightshade, nutsedge (prior to emergence)

Pesticide labels change often and vary regionally. As always, read and follow the label!

Stinger

Active ingredient	Clopyralid
Timing	Post-emergent, 2 to 8 leaf beets, 30 day pre-harvest interval
Weed spectrum	Common ragweed, hairy galinsoga, nightshades, prickly lettuce, annual sowthistle, wild buckwheat

Pesticide labels change often and vary regionally. As always, read and follow the label!

Spin-Aid

Active ingredient	Phenmedipham
Timing	Post-emergent, 2 leaf beets or later, 60 day pre-harvest interval
Weed spectrum	Wild mustard, common lambsquarters, shepherdspurse, common chickweed, common ragweed, common purslane, annual sowthistle

Pesticide labels change often and vary regionally. As always, read and follow the label!

UpBeet

Active ingredient	Triflusulfuron methyl
Timing	Post-emergent, 2 to 8 leaf beets, 30 day pre-harvest interval
Weed spectrum	Wild mustard, shepherdspurse, velvetleaf

Pesticide labels change often and vary regionally. As always, read and follow the label!

Common themes among red beet herbicides

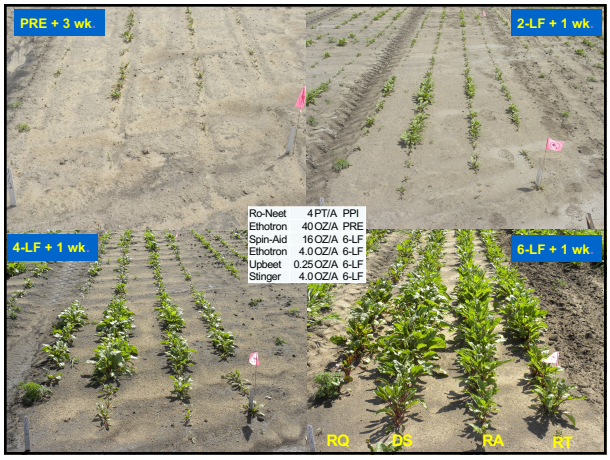
- Narrow spectrum of weed control, so they often need to be used together and in series
- The post-emergent products control very small weeds
- Limited options from after beet emergence until the 2 leaf beet stage

Beet Herbicide Efficacy Trials

Locations: Silt loam soil – Arlington, WI
Loamy sand soil – Plover, WI

Plover Location

Soil Type: Meehan Loamy Sand; OM 1.5-2.5%
Varieties: Ruby Queen, Detroit Supreme, Red Ace, Red Titan
Row Spacing: 19”
Plot Design: 6’ x 20’, 4 replications, with with one row of each variety per plot



Red beets:

Top yielding treatments across all varieties

3	Dual Magnum	7.62 EC	0.75 PT/A	PRE
	Ethotron	4 SC	1 PT/A	PRE
	Ethotron	4 SC	5.25 OZ/A	2-LF
	Upbeet	50 DF	0.13 OZ/A	2-LF
	COC	L	0.25 % V/V	2-LF
	Spin-Aid	1.3 EC	12 OZ/A	4-LF
	Ethotron	4 SC	3 OZ/A	4-LF
	Upbeet	50 DF	0.13 OZ/A	4-LF
	Stinger	3 SL	4 OZ/A	4-LF
	Spin-Aid	1.3 EC	16 OZ/A	6-LF
	Ethotron	4 SC	4 OZ/A	6-LF
	Upbeet	50 DF	0.25 OZ/A	6-LF
	Stinger	3 SL	4 OZ/A	6-LF

7	Dual Magnum	7.62 EC	0.75 PT/A	PRE
	Ethotron	4 SC	1 PT/A	PRE
	Ethotron	4 SC	3 OZ/A	2-LF
	Spin-Aid	1.3 EC	12 OZ/A	2-LF
	Upbeet	50 WDG	0.13 OZ/A	2-LF
	Spin-Aid	1.3 EC	12 OZ/A	4-LF
	Ethotron	4 SC	3 OZ/A	4-LF
	Upbeet	50 DF	0.13 OZ/A	4-LF
	Stinger	3 SL	4 OZ/A	4-LF
	Spin-Aid	1.3 EC	16 OZ/A	6-LF
	Ethotron	4 SC	4 OZ/A	6-LF
	Upbeet	50 DF	0.25 OZ/A	6-LF
	Stinger	3 SL	4 OZ/A	6-LF

11	Dual Magnum	7.62 EC	0.75 PT/A	PRE
	Ethotron	4 SC	40 OZ/A	PRE
	Ethotron	4 SC	10.5 OZ/A	6-LF
	Stinger	3 SL	6 OZ/A	6-LF
	Upbeet	50 DF	0.5 OZ/A	6-LF
	COC	L	0.25 % V/V	6-LF

12	Ro-Neet	6 EC	4 PT/A	PPI
	Ethotron	4 SC	40 OZ/A	PRE
	Spin-Aid	1.3 EC	16 OZ/A	6-LF
	Ethotron	4 SC	4 OZ/A	6-LF
	Upbeet	50 DF	0.25 OZ/A	6-LF
	Stinger	3 SL	4 OZ/A	6-LF

Lessons from red beet trials

- The loss of a.i. desmedipham (Alphanex, Betanex) is not catastrophic
- Varietal response to herbicides generally minor
- UpBeet provided excellent velvetleaf control
- Stinger in a single application had increased crop safety over a split-application

Integrated, non-herbicide components of a system

Stale seedbed:

1. Prepare seedbed about 3 weeks prior to planting
2. Allow weeds to germinate, water if necessary
3. Destroy emerged weeds:
   - Flaming
   - Shallow tillage
4. Plant with minimal soil disturbance

In-row cultivation tools: torsion weeder

- Very simple, affordable design
- Spring-loaded rods vibrate to disrupt young weeds
- Often belly-mounted on a small tractor
- Spacing can be easily changed

In-row cultivation tools: finger weeder

- Rotating fingers rip weeds from soil
- Often belly-mounted on a small tractor
- Spacing can be easily changed

In-row cultivation tools: star weeder

Source: Kress & Co.

Between-row tools: basket weeder

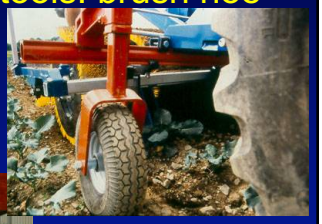
- Rolling baskets rip young weeds from soil
- Faster driving speeds
- Rocky and cloddy soils can be difficult
- Crop and weeds should be young (short)

Source: R. Durgy, Univ. Conn.

Between-row tools: brush hoe

- Combination of a road sweeper and a hook and ladder fire truck
- Creates dusty layer that reduces further weed germination
  - Dust layer extends into row
- Can destroy fairly large weeds
- Can be operated in fairly moist soil

Between-row tools: brush hoe



Thinking ahead: System components to consider next…

DOI: 10.5433/1679-0359.2017v38n4p1785

Beet seed priming with growth regulators

Condicionamento fisiológico de sementes de beterraba com reguladores de crescimento

Lucas Dotto[1]; Vanessa Neumann Silva[2*]

Abstract

Seed priming is a technique used to induce metabolic germination processes. Use of growth regulators in seed priming may facilitate increments in physiological processes during seed germination. The objective of this study was to evaluate the effect of priming and growth regulators on beet seed germination. The treatments were cultivar type (Early Wonder, Itapuã and Maravilha) and seed priming technique, which included a control (unconditioned seed) standard hydropriming (water) and a conditioning with salicylic, gibberellic and ascorbic acids, respectively. The treatments were defined by initially testing 0, 1, 2 and 4 mM ascorbic, gibberellic and salicylic acids. Before seed priming, imbibition seed curves were established to determine the optimal conditioning time. After conditioning, the germination, rate of germination, seedling length and seedling dry weight were evaluated. First, the appropriate dosage for conditioning was determined by using a completely randomized experimental design, with four replications per cultivar. Then, a 3 x 5 (cultivar x conditioning technique) factorial design was adopted. Whenever the results were significant by variance analysis, regression analysis was performed. Finally, Tukey's test was used to compare the means at P=0.05. Beet seed priming alters the potential of germination and is influenced by the cultivar and conditioning technique. Pretreatment with 1–2 mM ascorbic, gibberellic or salicylic acids, respectively, promotes beet seed germination, whereas at 1–3 mM, the growth of roots and shoots of beet seedlings is promoted. The most effective techniques to promote germination and growth of sugar beet seedlings were priming with water, salicylic acid or gibberellic acid.

Key words: *Beta vulgaris*. Hydropriming. Gibberellic acid. Salicylic acid. Ascorbic acid.

Thinking ahead: System components to consider next…

Effect of foliar spray with benzyladenine and gibberellic acid on growth, yield and some chemical constituents of fodder beet plant (*Beta vulgaris* L.).

By: El-Dayem, H. M. M.

Annals of Agricultural Science, Moshtohor
Volume: 37 **Issue:** 1 **Pages:** 249-274
Published: 1999
Document Type: Journal article

Abstract

Two field experiments were conducted in Egypt during the 1994/95 and 1995/96 season to study the effect of benzyladenine (25, 50 and 100 mg BA/litre) and gibberellic acid (100, 150 and 250 mg GA_3/litre) applied twice (70 and 90 days after sowing) as foliar spray on the growth, yield and some chemical constituents of the fodder beet plant (cv. Rozsa-szine Beta). Both BA and most GA_3 treatments significantly increased the root length and diameter, total leaf area per plant, fresh and dry weights of both roots and shoots, photosynthetic pigments, endogenous gibberellin- and cytokinin-like substances, percentage and total amount of N, P and K and total carbohydrates in both roots and leaves during most growth periods, as well as the roots and shoots of fodder beet yield and crude protein percentage at harvest time. An opposite trend in root diameter and fresh and dry weights of root yield as well as the percentage and total amount of N and P, total carbohydrates and crude protein percentage in the roots was observed at the treatment with 250 mg GA_3/litre (high level). The most effective concentrations found in this study that could increase fodder beet yield was 100 mg BA/litre, followed by 50 mg BA/litre, and then 150 mg GA_3/litre.

Can plant growth regulators make beets more competitive?

O mg/L GA **400 mg/L GA**

Thinking ahead: System components to consider next…

Effect of plant spacing on marketable yield of table beet (*Beta vulgaris* L.).

By: Gaharwar, A. M. ; Ughade, J. D.
View ResearcherID and ORCID (provided by Clarivate Analytics)

International Research Journal of Agricultural Economics and Statistics
Volume: 8 **Issue:** 1 **Pages:** 51-55
DOI: 10.15740/HAS/IRJAES/8.1/51-55
Published: 2017
Document Type: Journal article

Abstract

A field experiment to standardize package of practices for beet root cultivation in Vidarbha region and to find out optimum spacing for higher yield of marketable beet root during the winter seasons of three consecutive years was undertaken. The experiment was conducted in a Randomized Block Design at the farm of Agricultural Research Station (Dr. PDKV), Yavatmal. On the basis of spacing, plants were transplanted at two row spacing *viz.*, 30 cm and 45 cm and in row three plant to plant spacing *viz.*, 10 cm, 20 cm and 30 cm with one separate 45 cm * 45 cm wider spacing plot with three replications. The result indicated that different plant spacing had significantly influenced on shoot fresh weight, beet root fresh weight, diameter of beet root and marketable yield of beet root. Spacings have significant effect on marketable yield of beet root in the three seasons of experimentations. However, TSS content of beet root was in significantly influenced with different plant spacing. Beet root sown at closer planting distance 30 cm x 10 cm gave significantly higher marketable root yield but fresh weight of beet root was significantly greater under wider plant spacing.

Closing thoughts

- Organic or conventional, time to think about a weed control *system* instead of individual *tools* in a tool box

- Areas to consider next:
  - Row spacing
  - Cultivar selection
  - Planting timing
  - Natural plant growth regulators