

Growing Medicinal Herbs in Oregon

Small Farm School 2023

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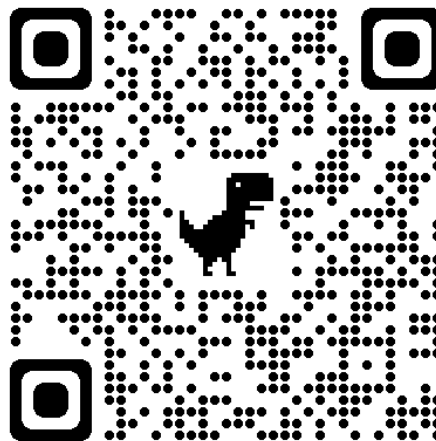


Oregon State University

**North Willamette Research
and Extension Center**

Session Outline

- OSU herb project overview
- Resources for production
- Our research so far:
 - Tulsi
 - Ashwagandha
- Profiles of 5 high potential crops
- Q and A



Rationale and Background



Alternative Crops Bring Sustainability to Willamette Valley Farms

Fresh market veg profits decreasing

- One farmer reported decreased farm income 25-50% in last 5 years
- Increased regulation, decreased revenue and increased perception of liability from Produce Safety Rule implementation
- Tough competition from imports

Building a path to market for local production

Funding with OR SCBG to put new crops on farms

Diversity in crops mirrors the diversity in our communities!



Goal:

Enable growers to the develop the domestic organic herb industry.

Practitioner Perceptions and Behavior Survey

Rate perceptions of available herbs

Assess the degree of knowledge and use of Chinese herbs

Quantify interest level in utilizing Chinese herbs that have been cultivated in the U.S.

69 providers across the U.S. completed the survey

If Chinese herbs were grown in the US, would you be interested in prescribing them?

Neutral (8%)

No (3%)

Yes (89%)

0 10 20 30 40 50 60 70



How are herbs currently used in practice?

In a given week, to what percentage of patients do you prescribe herbs?

58%

Approximately how many different Chinese herbs do you commonly prescribe in your practice?

96

Herbs frequently
prescribed—
past 12 months

#1 – **Bai Shao Yao** (White Peony Root)

#2 – **Dang Gui** (Angelica Root)

#3 – **Chai Hu** (Bupleurum Root)

#3 – **Gan Cao** (Licorice Root)

#4 – **Huang Qi** (Astragalus Root)

#4 – **Fu Ling** (Poria)

#5 – **Gui Zhi** (Cinnamon Twig)

#6 – **Bai Zhu** (Atractylodes)

#7 – **Huang Qin** (Scutellaria)

#8 – **Ban Xia** (Pinellia)

#9 – **Sheng Jiang** (Fresh Ginger)

#10 -- **Sheng Di Huang** (Rehmannia Root)

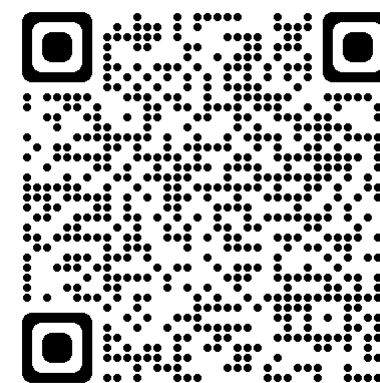
Potential crops for the Pacific Northwest

| Latin name | Common name | Pinyin name | Overall potential |
|---------------------------------|---------------------|---------------------|-------------------|
| <i>Astragalus membranaceus</i> | Astragalus | huáng qí | High potential |
| <i>Codonopsis pilosula</i> | Poor man's ginseng | dǎng shēn | High potential |
| <i>Scutellaria baicalensis</i> | Baikal skullcap | huáng qín | High potential |
| <i>Withania somnifera</i> | Ashwagandha | * | High potential |
| <i>Ocimum spp.</i> | Sacred basil/tulsi | * | High potential |
| <i>Salvia miltiorrhiza</i> | Red sage | dān shēn | High potential |
| <i>Rosa rugosa</i> | | Mei Gui Hua | High potential |
| <i>Gentiana scabra</i> | | lóng dǎn cǎo | High potential |
| <i>Plantago asiatica</i> | Plantain | chē qián zǐ | Average potential |
| <i>Prunella vulgaris</i> | Heal all | xià kū cǎo | Average potential |
| <i>Angelica dahurica</i> | | bái zhǐ | Average potential |
| <i>Arctium lappa</i> | Burdock | niú bang zǐ | Average potential |
| <i>Chrysanthemum morifolium</i> | Mum | jú huā | Average potential |
| <i>Carthamus tinctorius</i> | Safflower | hóng huā | Average potential |
| <i>Centella asiatica</i> | Gotu kolu | jī xuě cǎo | Average potential |
| <i>Platycodon grandiflorus</i> | Balloon flower | jié gěng | Average potential |
| <i>Schisandra chinensis</i> | Five flavored fruit | wǔ wèi zǐ | Average potential |
| <i>Polygonatum sibiricum</i> | | huáng jīng | Average potential |
| <i>Paeonia lactiflora</i> | White peony | bái sháo / chì sháo | Average potential |

Extension Bulletin:

Medicinal Herb Production in the Pacific Northwest: Opportunities and Obstacles in a Growing Market

Buckland et al., 2022



Overlap with Top 30 Crops

Astragalus membranaceus (growers #1, practitioner #4)

Scutellaria baicalensis (growers #3, practitioner #7)

Paeonia lactiflora (growers #19, practitioner #1)

Angelica acutiloba (growers #25, practitioner #2)

What about other herbs not used in TCM?

Conference identified “easy to adopt” crops

Transitioning to medicinal herb crops from vegetable

- Unique industry
- Steep learning curve on quality issues

Top recommended crops from experienced growers:

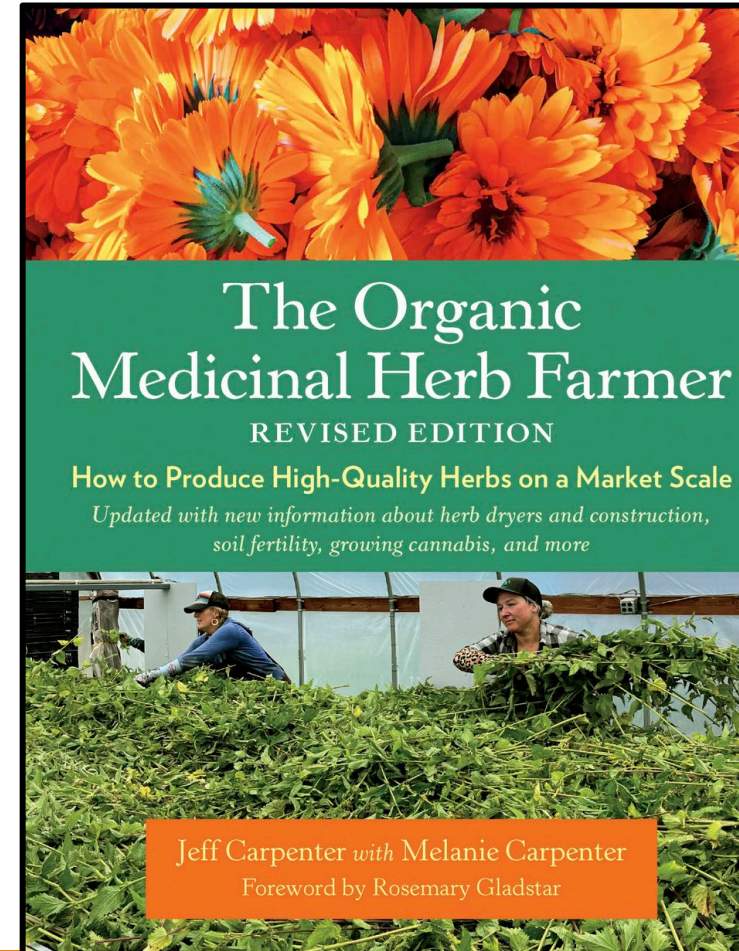
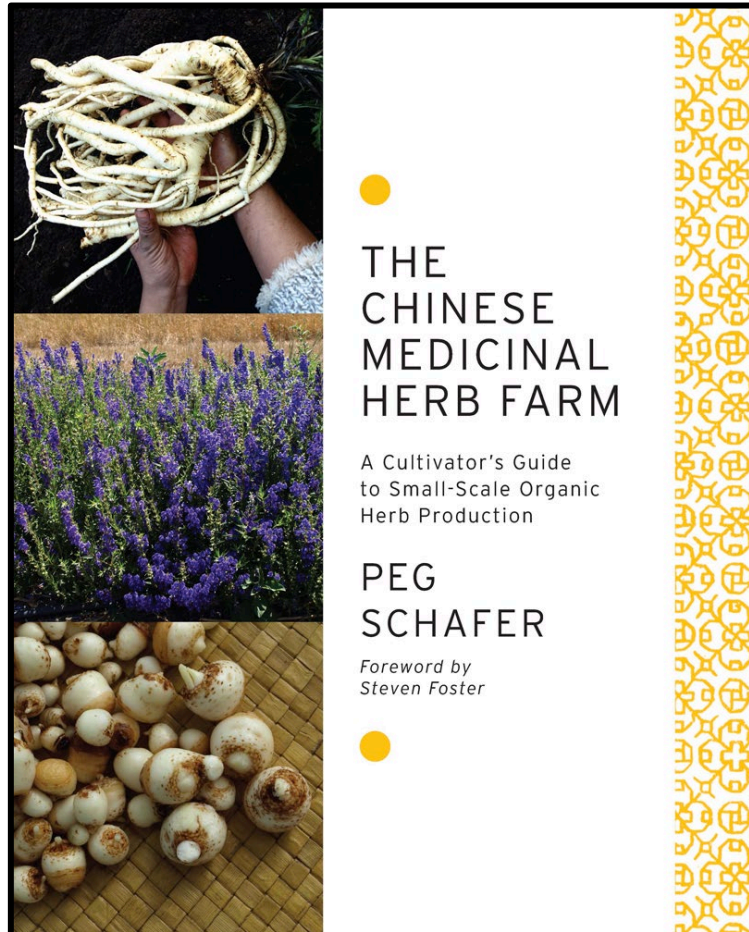
- Tulsi
- Ashwaghandha
- Astragalus
- Salvia miltiorrhiza (red sage)
- Bitter melon





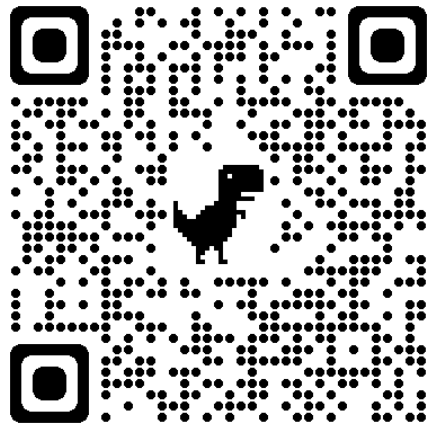
Resources for Herb Production

Resources for Herb Production: Books



Resources for Herb Production: Online

OSU Organic Nutrient Management Calculator
<https://smallfarms.oregonstate.edu/calculator>



Astragalus root (*Astragalus membranaceus*), recently harvested and washed at Pacific Botanicals, Grants Pass, OR



Enter nutrient analyses in the yellow cells

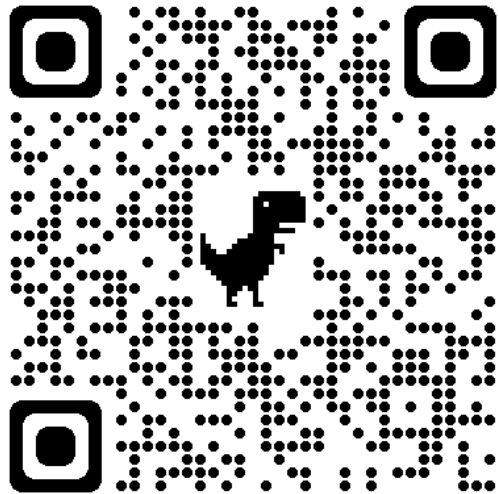
Results appear in the green cells

| MATERIAL | Total % N from label (fresh weight) | % Dry matter | 4 week PAN (% of total N, dry weight) | 10 week PAN (% of total N, dry weight) | 4 week PAN (lb per 100 lb product, fresh weight) | 10 week PAN (lb per 100 lb product, fresh weight) | P ₂ O ₅ (%) | K ₂ O (%) | Ca (%) | Mg (%) | S (%) |
|-------------------------------------|-------------------------------------|--------------|---------------------------------------|--|--|---|-----------------------------------|----------------------|--------|--------|-------|
| | ORGANIC FERTILIZERS | | | | | | | | | | |
| Blood meal (12.5-1.5-0.6) | 12.5 | 91 | 60 | 75 | 7.5 | 9.4 | 1.5 | 0.6 | | | |
| Bone meal (3-20-0.5) | 3.0 | 95 | 17 | 32 | 0.5 | 1.0 | 20.0 | 0.5 | | | |
| Chicken manure - dried (4-3-2) | 4.0 | 85 | 41 | 56 | 1.6 | 2.2 | 3.0 | 2.0 | 7.0 | 1.0 | 0.5 |
| Feather meal (granulated) (13-0-0) | 13.0 | 97 | 60 | 75 | 7.8 | 9.8 | 0.0 | 0.0 | | | |
| Fish meal (10-6-2) | 10.0 | 92 | 60 | 75 | 6.0 | 7.5 | 6.0 | 2.0 | | | |
| Meat and bone meal (7-8-0) | 7.0 | 93 | 60 | 75 | 4.2 | 5.3 | 8.0 | 0.0 | | | |
| Muriate of potash (KCl) (0-0-60) | 0.0 | 100 | 0 | 0 | 0.0 | 0.0 | 0.0 | 60.0 | | | |
| Soy meal (6.5-1.5-2.4) | 6.5 | 90 | 60 | 75 | 3.9 | 4.9 | 1.5 | 2.4 | | 3.0 | |
| Sulfate of potash (0-0-50) | 0.0 | 99 | 0 | 0 | 0.0 | 0.0 | 0.0 | 50.0 | | 0.0 | 17.0 |
| Sulfate of potash magnesia (0-0-22) | 0.0 | 99 | 0 | 0 | 0.0 | 0.0 | 0.0 | 22.0 | | 10.8 | 22.0 |
| | | | 0 | 0 | 0.0 | 0.0 | | | | | |
| | | | 0 | 0 | 0.0 | 0.0 | | | | | |
| | SYNTHETIC FERTILIZERS | | | | | | | | | | |
| Triple super phosphate (0-40-0) | 0.0 | N/A | 100 | 100 | 0.0 | 0.0 | 40.0 | 0.0 | | | |
| Urea (46-0-0) | 46.0 | N/A | 100 | 100 | 46.0 | 46.0 | 0.0 | 0.0 | | | |
| | | N/A | 100 | 100 | 0.0 | 0.0 | | | | | |
| | | N/A | 100 | 100 | 0.0 | 0.0 | | | | | |
| | COMPOST | | | | | | | | | | |
| Composted manure (1.5-0.5-0.5) | 1.5 | 60 | 5 | 10 | 0.1 | 0.2 | 0.5 | 0.5 | 1.8 | | |
| | | | 0 | 0 | 0.0 | 0.0 | | | | | |
| | | | 0 | 0 | 0.0 | 0.0 | | | | | |

<https://smallfarms.oregonstate.edu/calculator>

Resources for Herb Production: Online

- American Herbal Pharmacopoeia
<https://herbal-ahp.org/>



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American Herbal Pharmacopoeia[®] *and Therapeutic Compendium*

Ashwagandha Root

Withania somnifera

ANALYTICAL, QUALITY CONTROL,
AND THERAPEUTIC MONOGRAPH

APRIL 2000

EDITOR: ROY UPTON HERBALIST

Associate Editor

Cathirose Petrone

Research Associate

Diana Swisher BA



Monograph example

NOMENCLATURE

Botanical Nomenclature

Withania somnifera (L.) Dunal.

Botanical Family

Solanaceae

Definition

Ashwagandha consists of the dried roots of *Withania somnifera* (L.) Dunal. conforming to the methods of identification provided.

Common Names

| | |
|----------------|---|
| United States: | Ashwagandha (<i>Herbs of Commerce</i>). |
| Bengali: | As'vagandha, ashvagandha. |
| Gujarati: | Asgandha, asan, asoda, ghoda asoda. |
| Hindi: | Asgandh, A sh a ga n dha. |
| Sanskrit: | Ashwagandha (syn.: ashvagandha, asvagandha, hayagandha, vajjigandha). |
| Unani: | Asgand. |

HISTORY

The use of ashwagandha in ayurvedic medicine dates back 3000-4000 years to the teachings of the famed ayurvedic scholar Punarvasu Atreya. Subsequently, it was included in the writings of Charaka, Sushruta, and many other ayurvedic scholars throughout the centuries (Atal and Schwarting 1961). Ashwagandha, derived from the Sanskrit *ashva* meaning "horse" and *gandha* meaning "smell", describes the strong aroma of the root which is considered to be reminiscent of a horse's skin, sweat, or urine, depending upon to which authority one refers. The species name *somnifera* refers to the Latin *somnus* meaning "to sleep", apparently alluding to the use of ashwagandha as a nervine and seda-



Figure 1 Ashwagandha *Withania somnifera* (L.) Dunal.

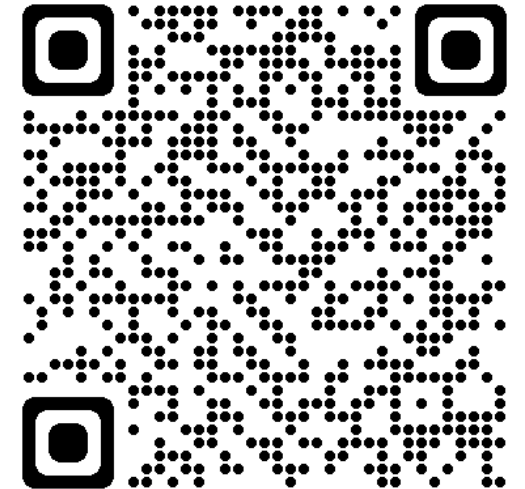
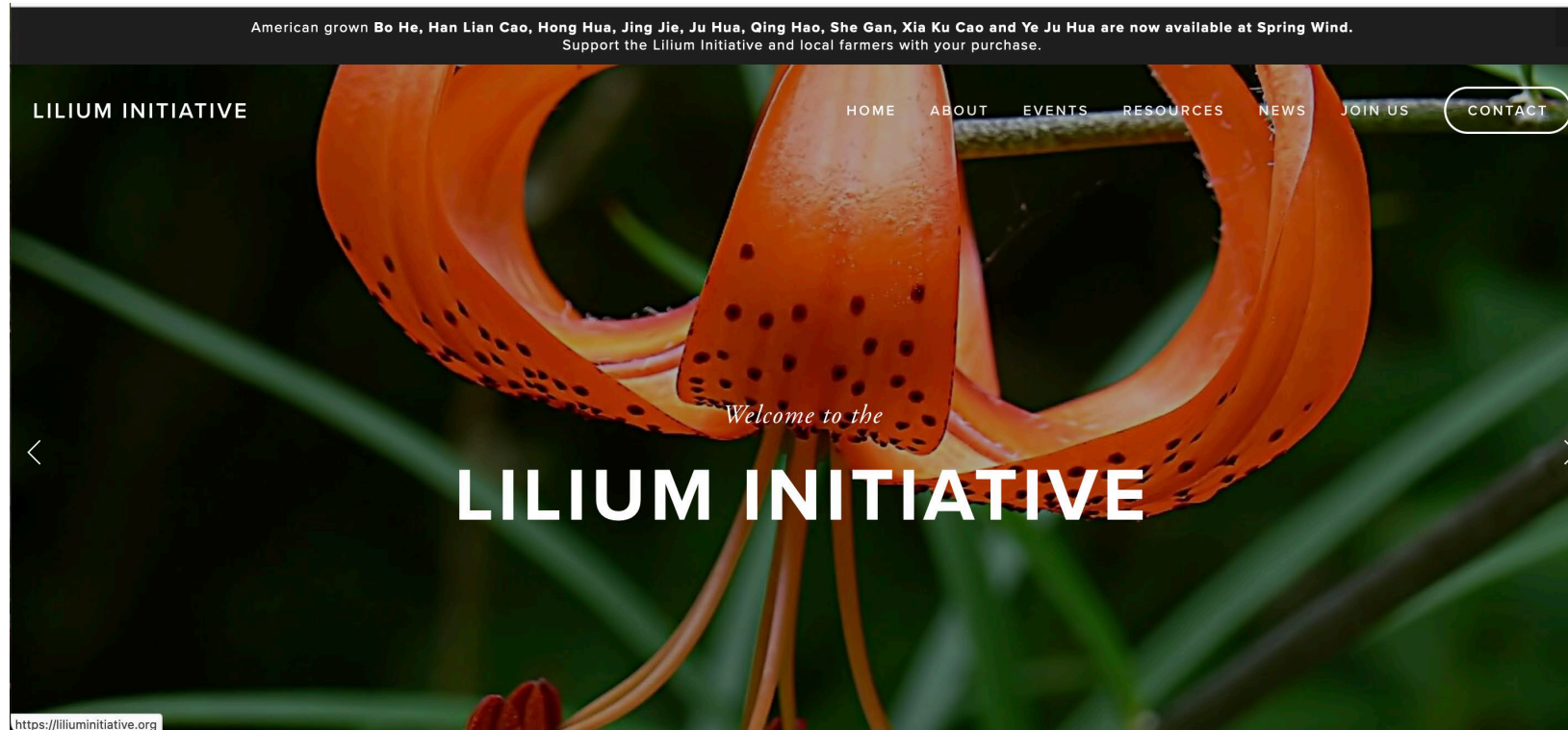
Art courtesy of Sabinsa Corporation, Piscataway, NJ

chitis, lumbago, and arthritis; and also promoted conception. In the Punjab region, it was similarly used as an aphrodisiac and for lower back pain.

Ashwagandha has been used in traditional herbal healing practices of Africa. The Southern Sotho prepared a decoction of the roots for colds and chills. The Transvaal Sotho used the root to tone the uterus in women who habitually miscarry, a use commonly employed in India as well. It has also been used to facilitate expulsion of the after-birth. An infusion of the root bark has been used for asthma, a use also common to traditional herbal practices in India (Watt and Breyer-Brandwijk 1962). In the United States

Resources for Herb Production: Online

- The Liliu Initiative <https://liliuminitiative.org/>



Our Production Research Tulsi and Ashwagandha





Effects of Timing and Harvest Method on Yield and Quality of Tulsi (*Ocimum africanum*)

Rachel Cross, Graduate Research Assistant

Kristie Buckland, Assoc. Professor, Vegetable and Specialty
Seed Crops Specialist

Ann Rasmussen, PhD, Senior Faculty Research Assistant



Oregon State University

North Willamette Research
and Extension Center

Research Questions

Do multiple harvest dates change plant yield and quality?

Does harvest method change plant yield and quality?





Experimental Design

RCBD with 4 reps

Two factors:

Harvest method (3 levels: hand, swather, combine)

Number of harvests (double or single)

Response variables

- Time to harvest
- Total yield
- % Eugenol

Methods

Ocimum africanum

Seeded in greenhouse: 5/23/22

Transplanted at approximately 6 weeks

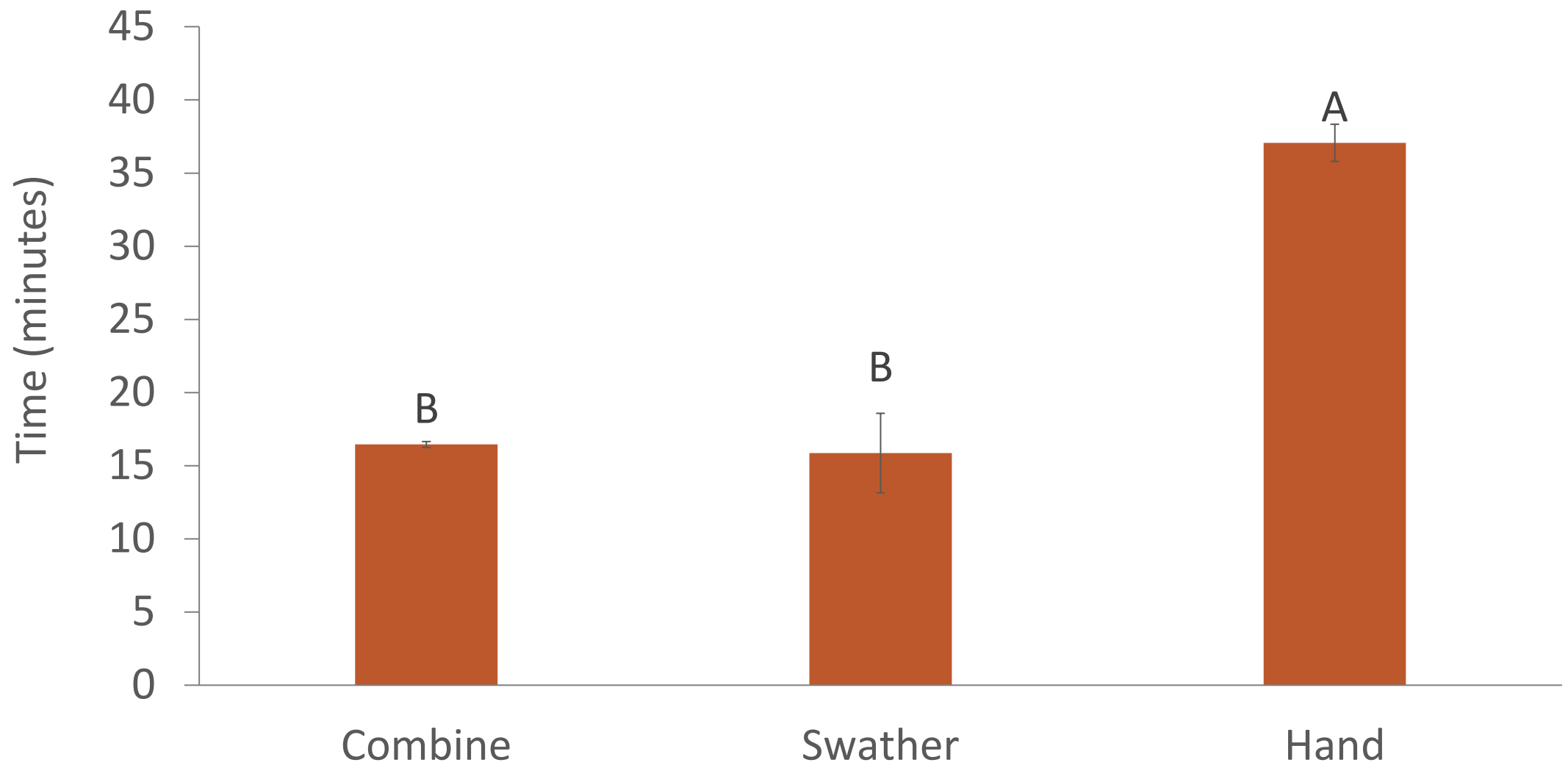
Fertilizer rates:

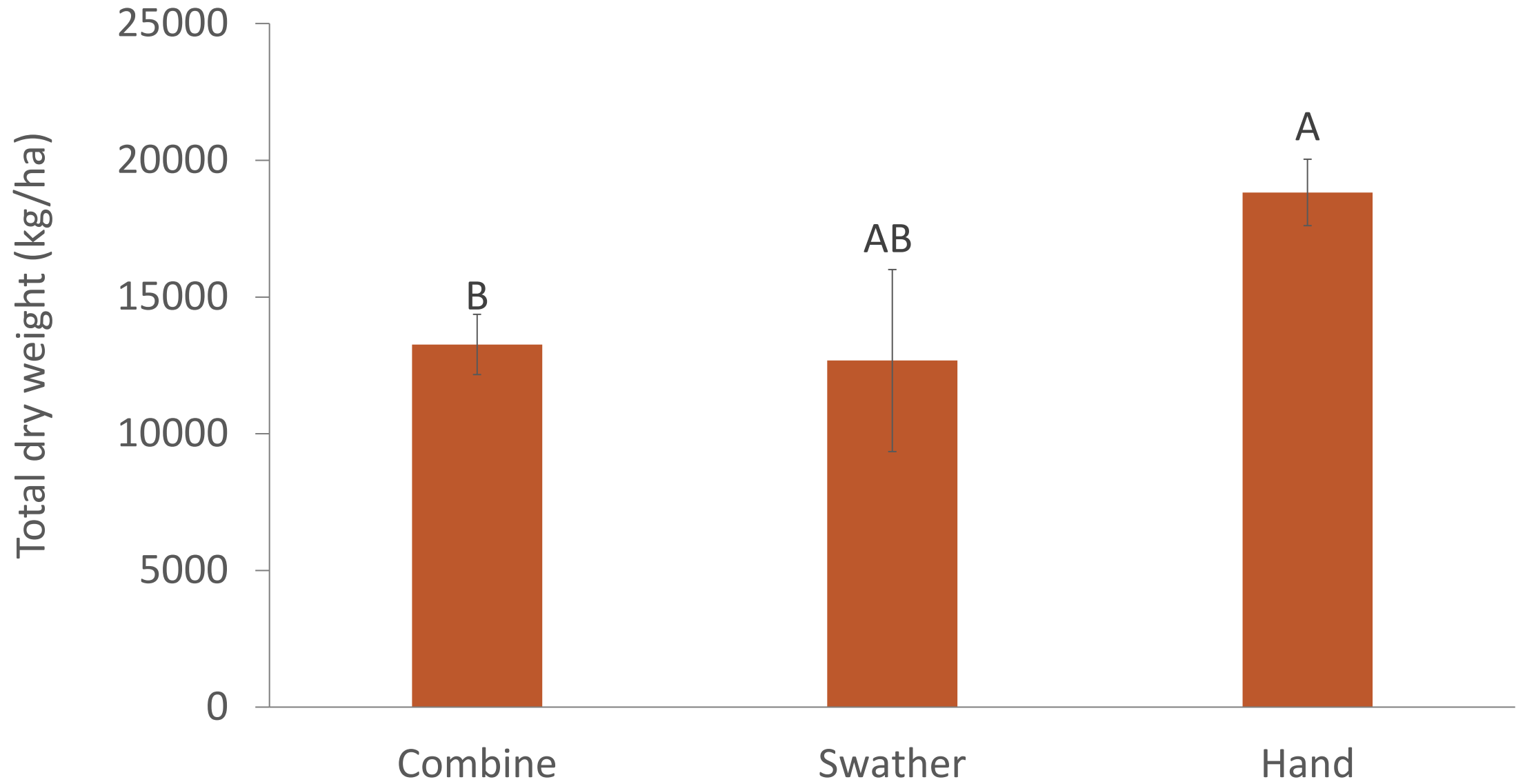
- Estimated 37.25 lb/acre PAN from CC
- Plus approx. 1,300 lb/acre pelleted chicken manure (4-3-2)

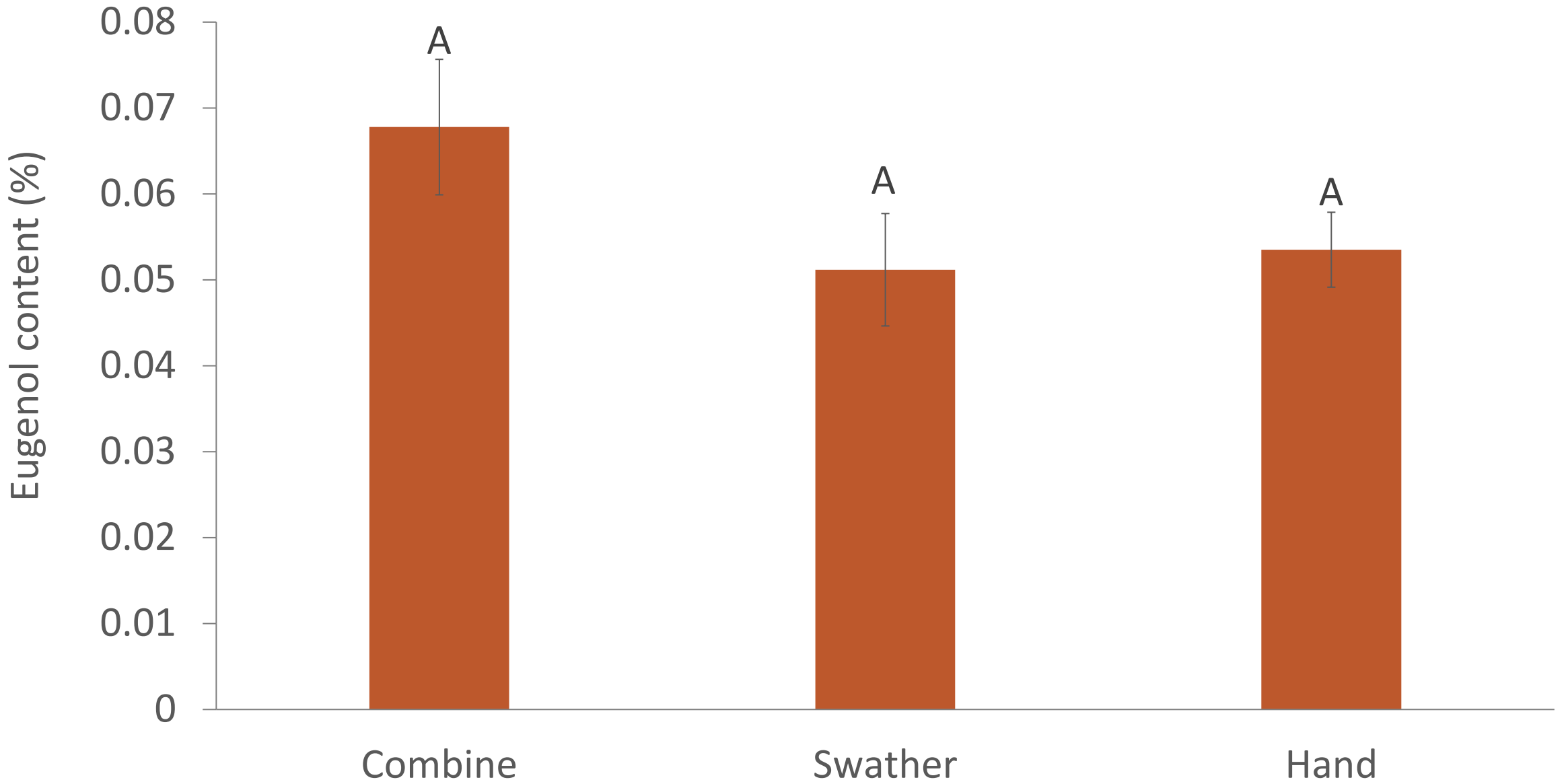
Harvest dates:

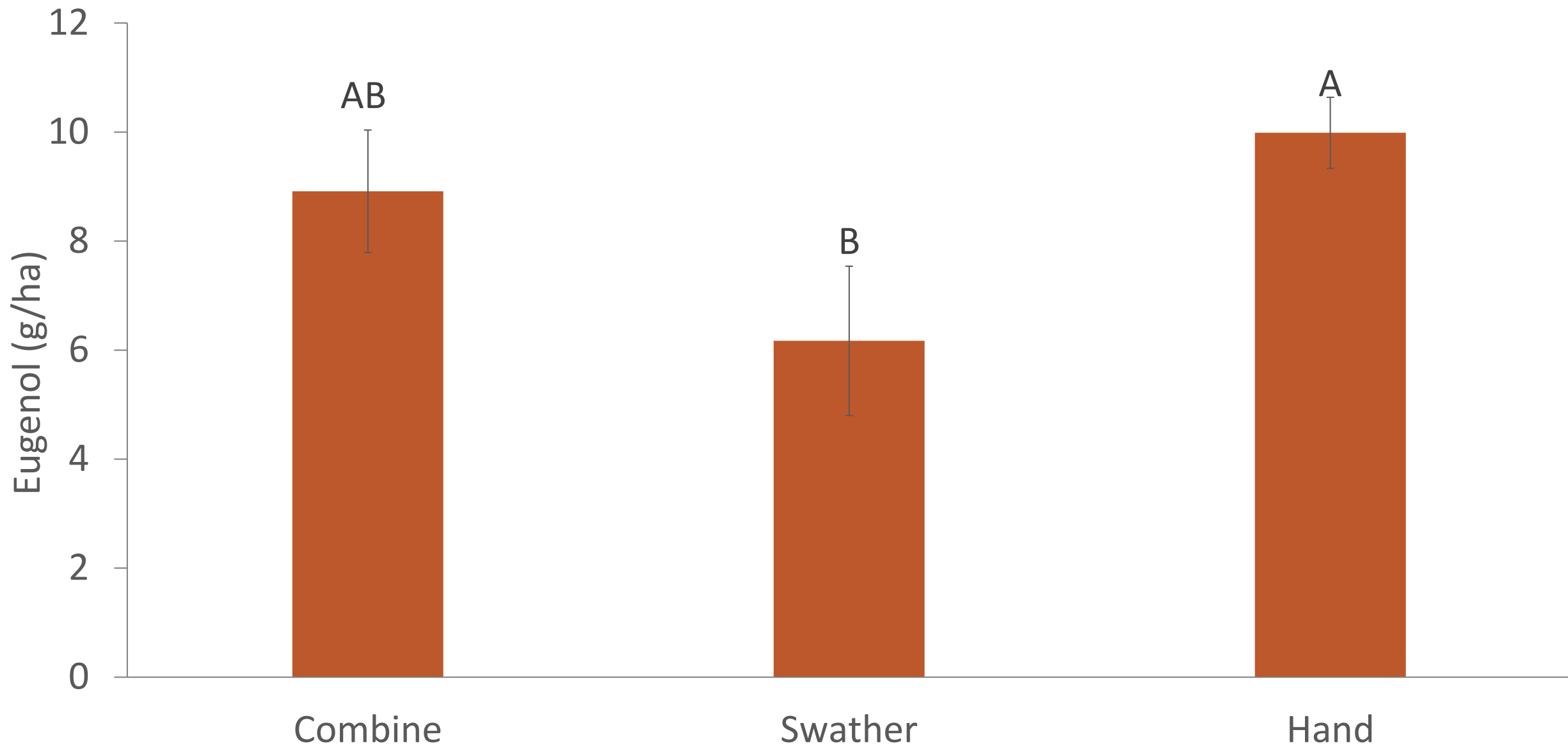
- Sept 2, 2022
- Oct 6, 2022









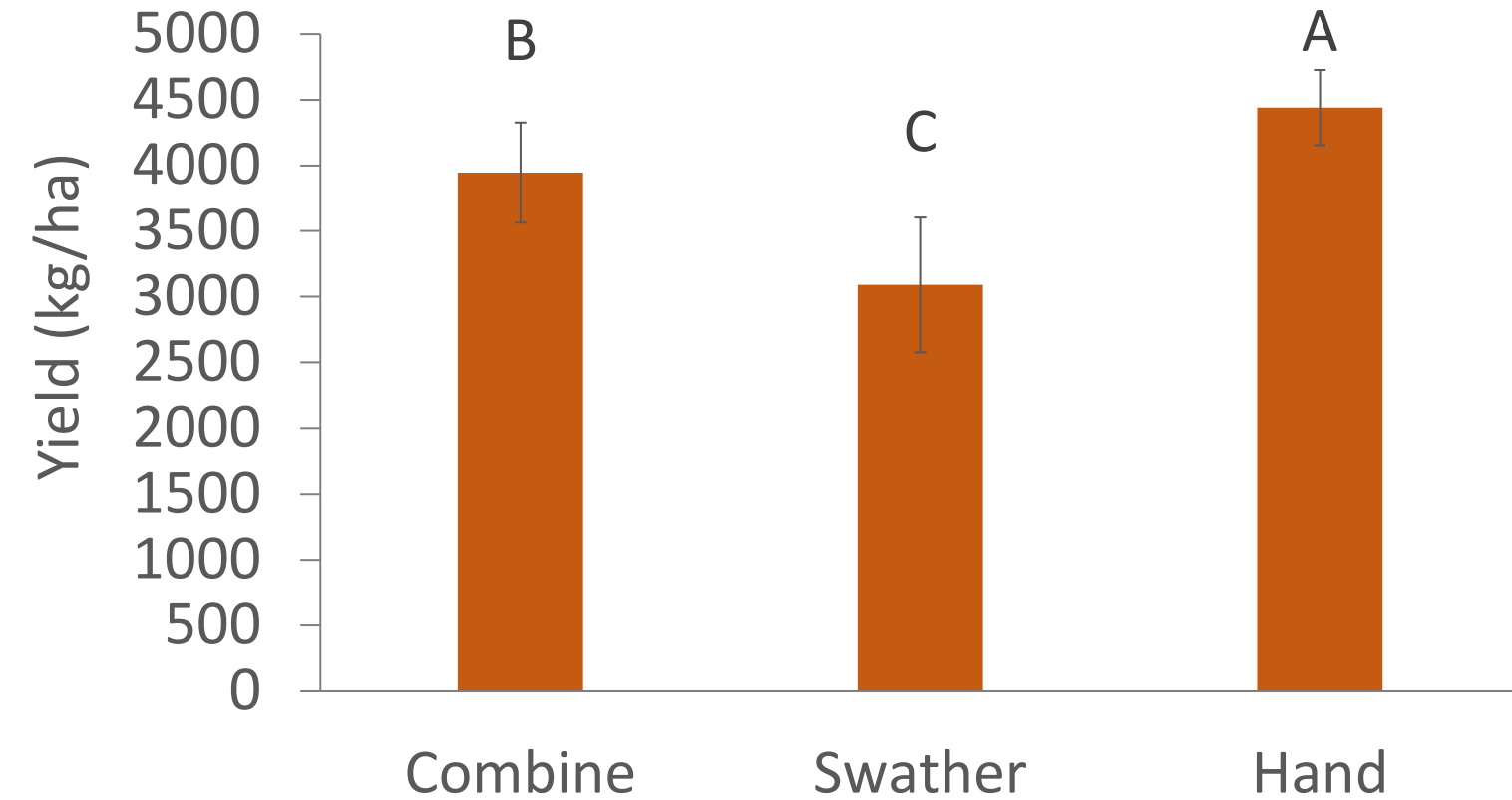


Season totals

Main effect of harvest method was important in total yield

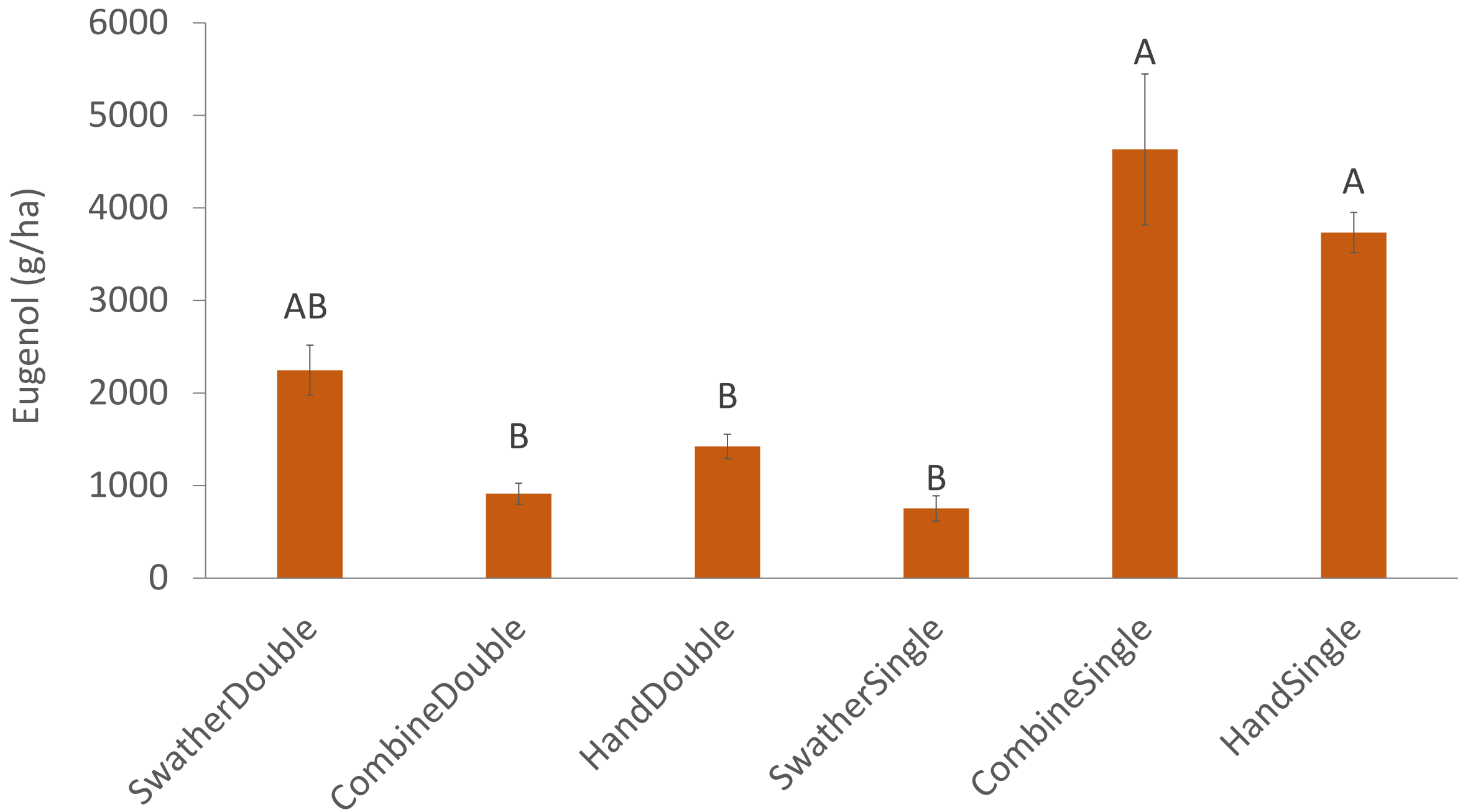
Significant interactions of harvest method and number of harvests for other measures



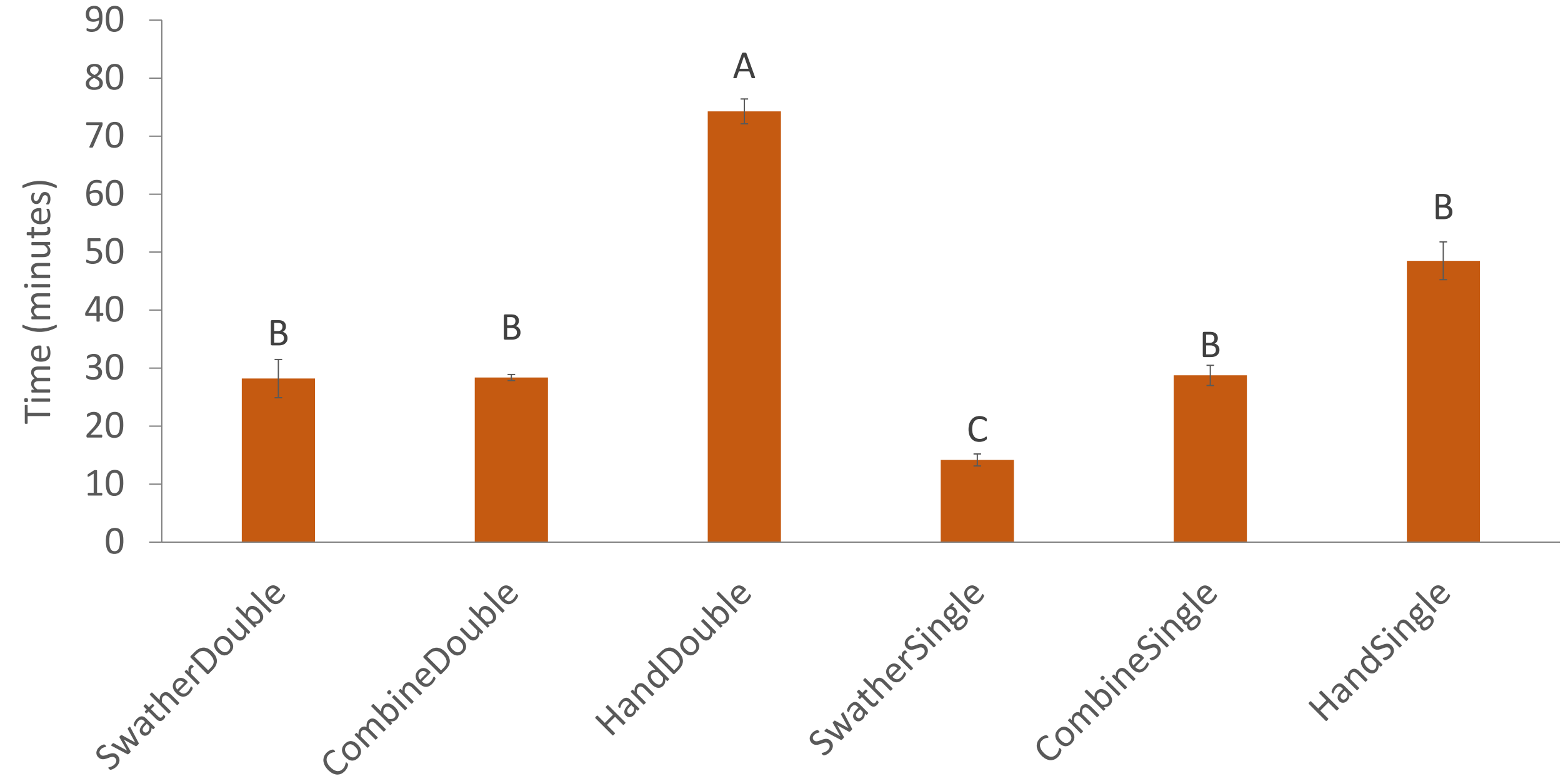


Total Season Yield

- Main effect of harvest method was significant
- Number of harvests was not significant



Total season harvest time



Conclusions

- Hand harvest was the greatest amount at each harvest
- Total season yield was greatest in hand harvest, followed by combine, then swather
- Total yield (grams) of eugenol was highest in single cuts of combine and hand harvest
- Decisions about method of harvest might depend on final market use of Tulsi

2023 Ashwagandha Field Trials

2 sites:

North Willamette
Research and Extension
Center, Aurora

&

Lewis-Brown Farm,
Corvallis



Research Questions

Can seed treatment improve germination?

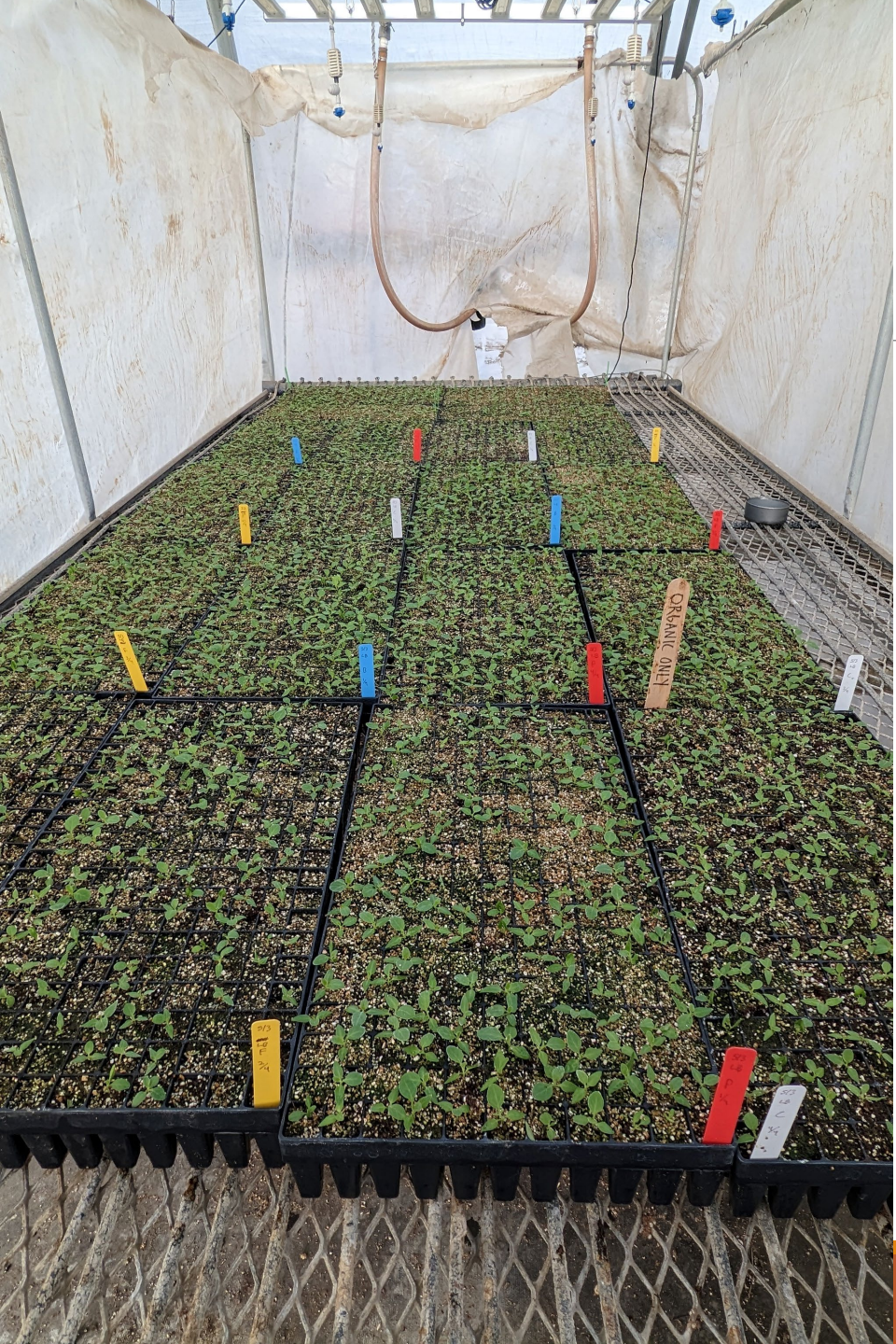
Can seed treatment improve transplant vigor?

How does in-field fertility affect yield?

How does in-field fertility affect medicinal properties?

Do seed treatments and fertility treatments interact with each other?





Seed Treatments

- Nothing (control)
- OTC 3% hydrogen peroxide
- Fungi-based biological product (Down to Earth Soluble Root Growth Enhancer, 11 fungi species plus humic acids)
- Bacteria-based biological product (JHB SeedUp, *Bacillus subtilis* and *Bacillus licheniformis* plus humic acids)



Fertility Treatments

- Cover crop only
 - Rye/vetch at NWREC
 - Winter pea at LB
- Cover crop plus an application of Pro-Pell-It! 12.5-0-0 feathermeal at 600 # / acre
- Cover crop plus an application of Pro-Pell-It! 12.5-0-0 feathermeal at 300 # / acre plus 2 applications of a beneficial bacteria (Blacksmith Bioscience Nitryx, species *Paenibacillus polymyxa*)

Process for Adopting New Crops



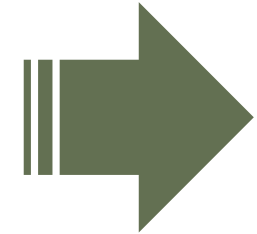
Identify the plant
family



What is something
similar that I have
grown before or can
find information
about?



Look for varieties that
are locally grown and
regionally specific



Try it out!
(AND SEEK OUT
SUPPORT)

Crop Profile: Tulsi

***Ocimum* spp.** \

Family: Lamiaceae

Part used: leaves

Life history: tender annual

Transplant time: 6 weeks

Spacing: 7 - 14" in row, 30" between row

Harvest date: June – October, multiple cuttings

Yield per acre: 2,200 - 2,600 lbs dry weight

Price per lb: \$16-30, dried crop



Tulsi: Special Considerations

- Some growers report transplant shock- can be hard to establish in field. Pinching helps.
- Need to optimize size/timing of transplants to allow for multiple cuttings per season.
- There are multiple species of tulsi.



Ocimum africanum



**Ocimum sanctum/
Ocimum tenuiflorum**



Ocimum gratissimum

| | |
|-------------------|---------------------------|
| Tulsi 'Temperate' | <i>Ocimum africanum</i> |
| Tulsi 'Krishna' | <i>Ocimum tenuiflorum</i> |
| Tulsi 'Rama' | <i>Ocimum tenuiflorum</i> |
| Tulsi 'Vana' | <i>Ocimum gratissimum</i> |

Crop Profile: Ashwagandha

Withania somnifera

Family: Solanaceae

Part used: root

Life history: tender perennial (annual in OR)

Transplant time: 10 – 12 weeks

Spacing: 7 -14" in row, 30" between row

Harvest date: October, after frost

Yield per acre: 1000 – 1800 lbs dry weight

Price per lb: \$12-24, dried crop



Ashwagandha: Special Considerations

- Light dependent germinator; germination can be erratic
- Prefers long days and warm nights
- Roots can be up to 3 ft long. Raised beds improve drainage and ease of harvest.

Crop Profile: Astragalus

Astragalus membranaceus

huáng qí

Family: Fabaceae

Part used: root

Life history: hardy perennial

Transplant time: 8 – 12 weeks

Spacing: 12 - 24" in row, 30" between row

Harvest date: Late fall

Yield per acre: 800 lbs dry weight

Price per lb: \$16-24, dried crop



Astragalus: Special Considerations

- Harvest is recommended after 3 - 4 years
- Oregon growers report up to 25% stand loss over winter, so they limit production to one over-wintering cycle only.
- Sensitive to over-watering or standing water in winter.
- Prone to soil-borne fungal diseases.

Crop Profile: Red Sage

Salvia miltiorrhiza
dān shēn

Family: Lamiaceae

Part used: root

Life history: hardy herbaceous perennial

Transplant time: 8 – 12 weeks

Spacing: 12 - 24" in row, 12"- 30" between row

Harvest date: Late fall/winter

Yield per acre: 2,500 lbs dry weight

Price per lb: \$17 -36, dried crop



Red Sage: Special Considerations



- Bottom heat aids in germination. Prefers a deeper cell. Pots up well.
- Should be planted in spring and harvested in fall/winter of 2nd or 3rd year for roots of adequate size.
- Needs to be harvested when plant is dormant and air temp is 20-25 °F – timing likely to be late in fall/winter in our area, when fields are wet.

Crop Profile: Bitter Melon

Momordica charantia

kǔ guā

Family: Cucurbitaceae

Part used: fruit

Life history: tender annual

Transplant time: 4 weeks, or direct seed

Spacing: 24" in row, 30" between row

Harvest date: late summer until frost

Yield per acre: unknown

Price per lb: unknown



Bitter Melon: Special Considerations

- Soaking seed overnight and bottom heat aids in germination.
- Susceptible to same problems as other cucurbits, including mildews and cucumber beetles.
- Trellis for ease of harvest.
- Culinary and medicinal.

Ashwagandha

Withania somnifera

- Solanaceae family
- Light dependent germinator
- Sow indoors; 10 weeks to transplant
- Long days and warm nights
- Post-harvest drying 100-110° F
- Retail price \$12-24 per lb dry root

| Farm | Density | Spacing | Harvest Timing | Expected Yield |
|----------------------|------------------------|--------------------------------------|-------------------|--|
| A | 19,000 plants per acre | 28" between rows, 12" in-row spacing | Early October | 1800 lbs dried root/acre |
| B | 30,000 plants per acre | 30" between rows, 7" in-row spacing | Mid-late Oct | 2021- 720 lbs dried root/acre (abnormal year) |
| C¹ | | 24" between plants | | 0.5 lb fresh per plant per season (irrigated crops) 3:1 drying ratio |
| D² | | 28" between rows, 12" in row spacing | After first frost | 1000 lbs/acre dried root |

C¹ Chinese Medicinal Herb, P. Schafer

D² The Organic Medicinal Herb Farmer, J. Carpenter and M. Carpenter

Tulsi

Ocimum spp.

- Lamiaceae family
- Tender annual
- Species discussion (next slide)
- Long germination time
- Sow indoors; transplant at 6+ weeks
- Harvest when cool, process immediately
- Post-harvest drying 100-110° F
- Retail prices \$16-30 lb dry

| Farm | Density | Spacing | Harvest Timing | Harvest note | Expected Yield |
|----------------------|--------------------|--------------------------------------|--|---|---|
| A | 19,000 plants/acre | 28" between rows, 12" in-row spacing | 1st cutting ~July 4th and then every 3-4 weeks later thru early Oct | | 2,600 lbs dried/acre |
| B | 30,000 plants/acre | 30" between rows, 7" in-row spacing | Single cutting mid-late Sep | | 2,220 lbs dried/acre |
| C¹ | | 12" between plants | When it starts to bloom; up to 3 times per season | Hand harvest just above where branching starts. Subsequent harvests- above previous cuts. | 1 lb fresh per plant per season. drying ratio 10:1 |
| D² | | 28" between rows, 12" in-row spacing | At flowering but before seed; harvest entire aerial part of the plant with multiple cuttings (3-4) | Harvest at flowering but before seed. Harvest whole plant, leaving 6"-8" to regenerate | 2,400 lb/acre dry with multiple cuttings (4:1 drying ratio) |

C¹ Chinese Medicinal Herb, P. Schafer

D² The Organic Medicinal Herb Farmer, J. Carpenter and M. Carpenter

Tulsi 'Temperate'

Ocimum africanum

Tulsi 'Krishna'

Ocimum tenuiflorum

Tulsi 'Rama'

Ocimum tenuiflorum

Tulsi 'Vana'

Ocimum gratissimum

Red Sage

Salvia miltiorrhiza
dān shēn

- Lamiaceae family
- Hardy perennial (zones 6-9)
- Sow indoors; transplant at 10 weeks
- 10-21 days to germ indoors (bottom heat helps)—consider deeper flats
- Post-harvest handling—washing, slicing, drying
- Prices???

| Farm | Density | Spacing | Harvest Timing | Harvest Stages | Post-Harvest | Expected Yield |
|----------------------|---------|--------------------------------|---|----------------|---|---|
| A | | | | | | |
| B | | | | | | |
| C¹ | | 12"-24" between row and in row | one year or older roots, late fall and early spring | winter dormant | remove crown and small rootlets, power wash, slice into 1/4" slices and dry | 0.25-0.5 lbs fresh per 2-year old roots; drying ratio 4:1 |
| D² | | | | | | |

C¹ Chinese Medicinal Herb, P. Schafer

D² The Organic Medicinal Herb Farmer, J. Carpenter and M. Carpenter

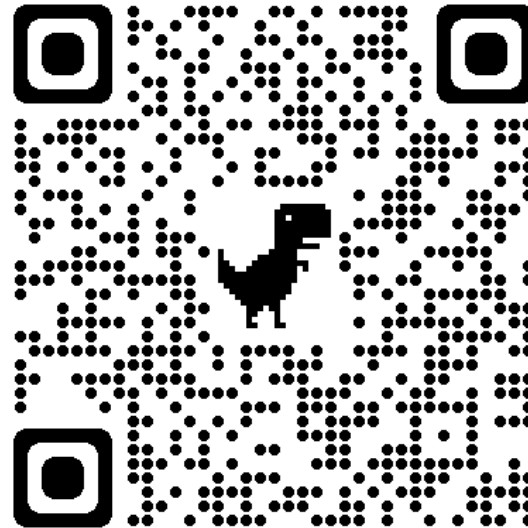
Summary

- Medicinal herb industry relies heavily on imports
- Potential for success domestic production is high!
- Look for 'easy' to grow crops to start – remember the industry/market aspect take new connections too
- Crop profiles for 5 crops
- Extensive resource list throughout the workshop

Reach out!

This presentation available:

<http://PNWHerbs.org>



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