

Canola: A Multipurpose Alternative Crop for the Region

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Outline

- **Canola Introduction**
- **Benefits of Canola**
- **Challenges of Growing Canola**
- **Lessons Learned**
 - ✿ **Canola Research**
- **Summary**

What is Canola?

Canola Development

Univ. of Manitoba, Canada (1970's)

Rape Seed



Canola

- Reduced Erucic Acid
- Reduced Glucosinolates

Species

Brassica napus
(Argentine canola)



- Longer duration
- Higher yielding

Brassica rapa
(Polish canola)



- Shorter duration
- Lower yielding

Brassica juncea
(Indian mustard)



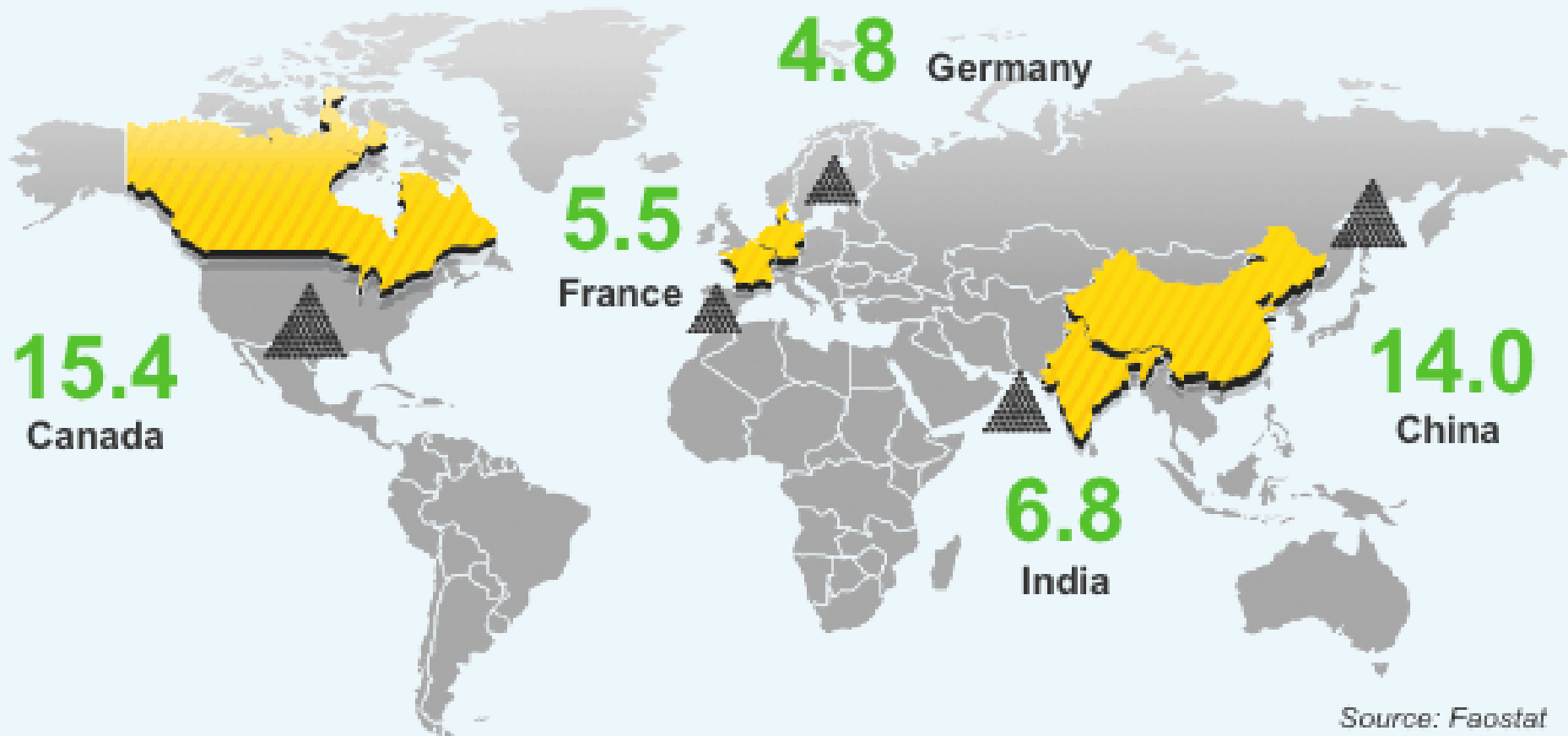
- More heat & drought tolerance
- More arid areas

Brassica carinata
(Euthiopean mustard)

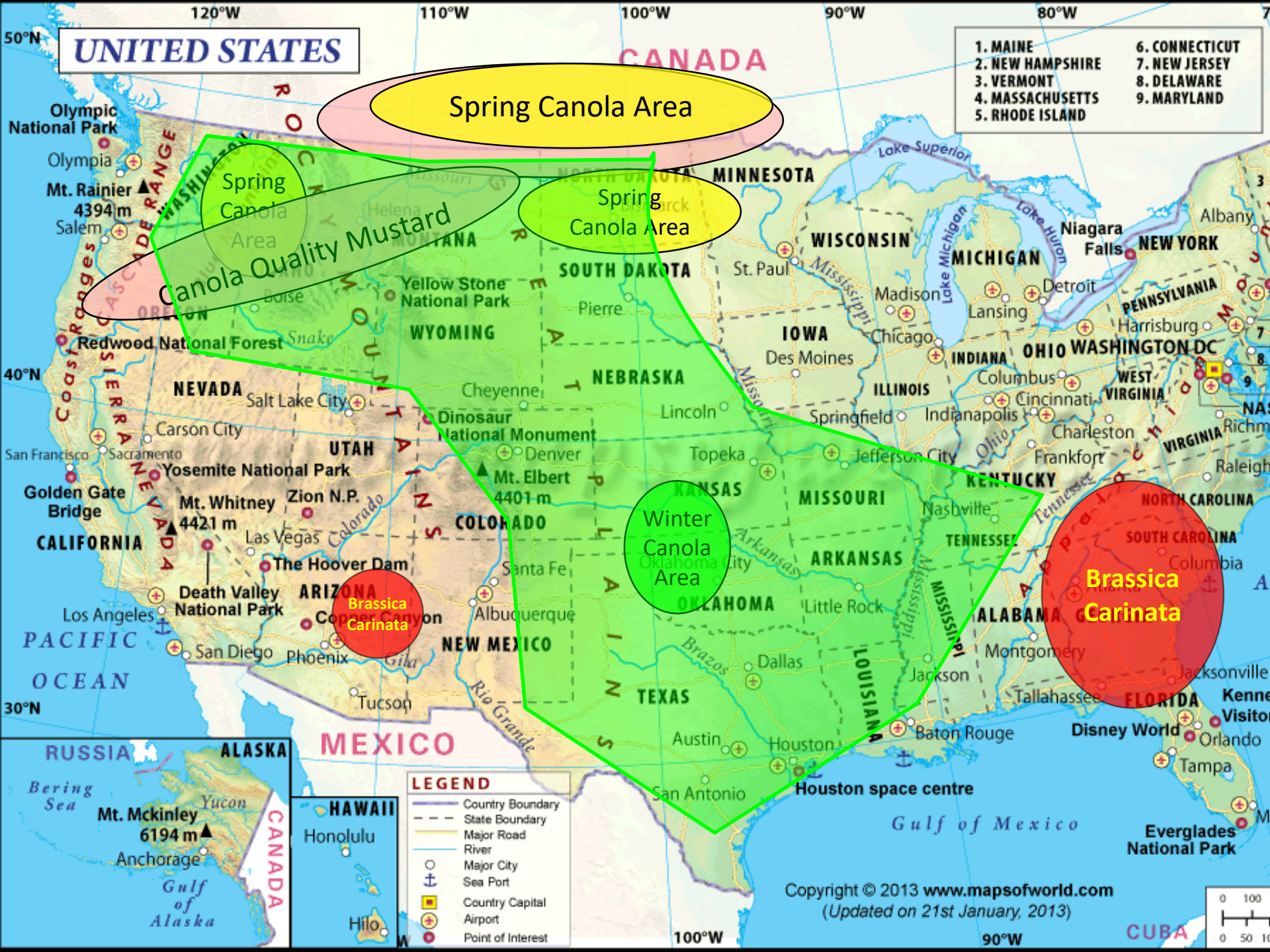


- Even More heat & drought tolerance
- Jet fuel development

The most important canola-growing nations



Source: Faostat



UNITED STATES

- | | |
|------------------|----------------|
| 1. MAINE | 6. CONNECTICUT |
| 2. NEW HAMPSHIRE | 7. NEW JERSEY |
| 3. VERMONT | 8. DELAWARE |
| 4. MASSACHUSETTS | 9. MARYLAND |
| 5. RHODE ISLAND | |

Spring Canola Area

Spring Canola Area
Canola Quality Mustard

Spring Canola Area

Winter Canola Area

Brassica Carinata

Brassica Carinata

LEGEND

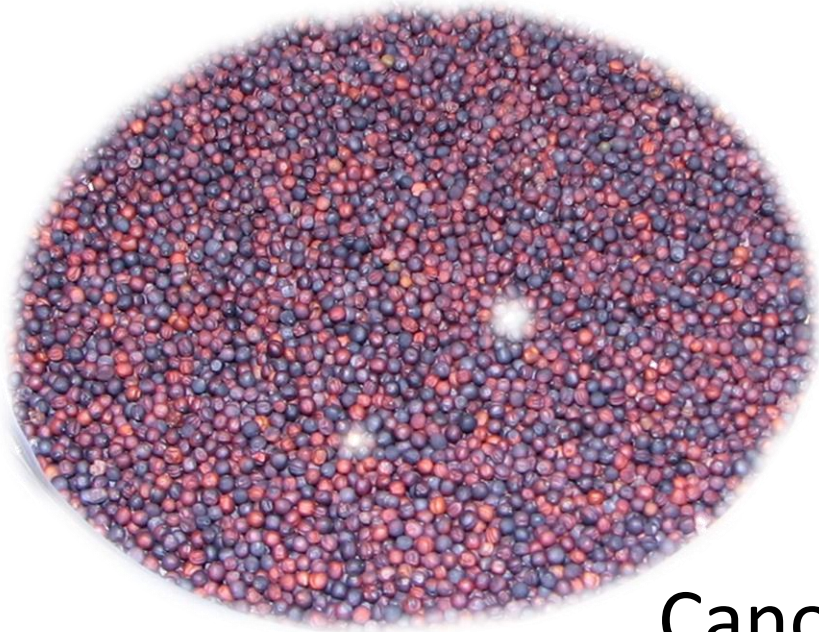
- Country Boundary
- State Boundary
- Major Road
- River
- Major City
- Sea Port
- Country Capital
- Airport
- Point of Interest

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Canola Seed



Canola Oil



(Amazon.com)

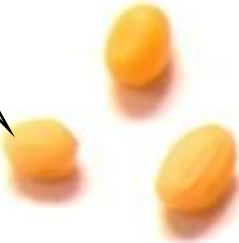
Canola Meal



(Alibaba.com)

Canola Production

Mustard

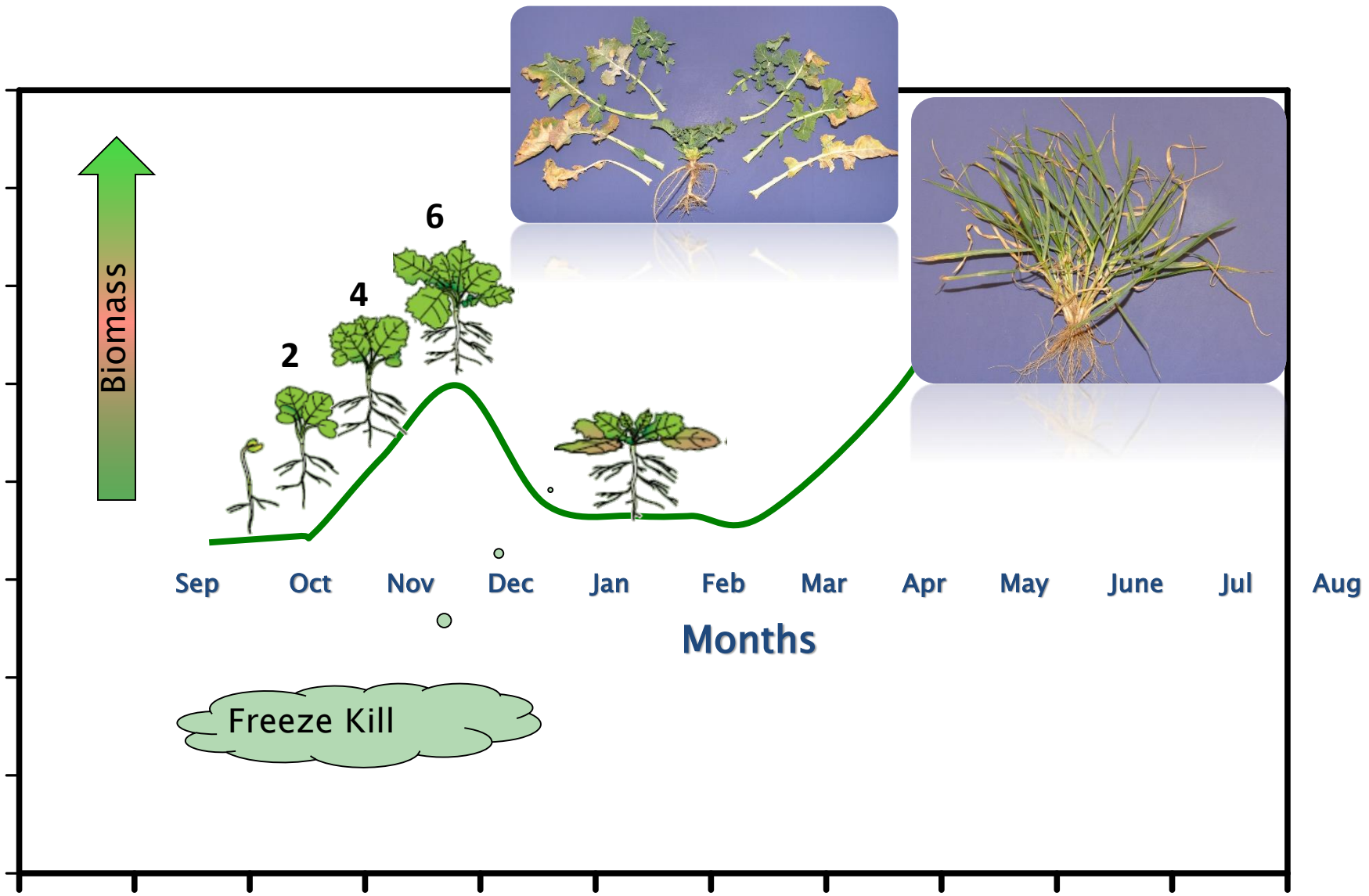


Canola



Wheat





Biomass ↑

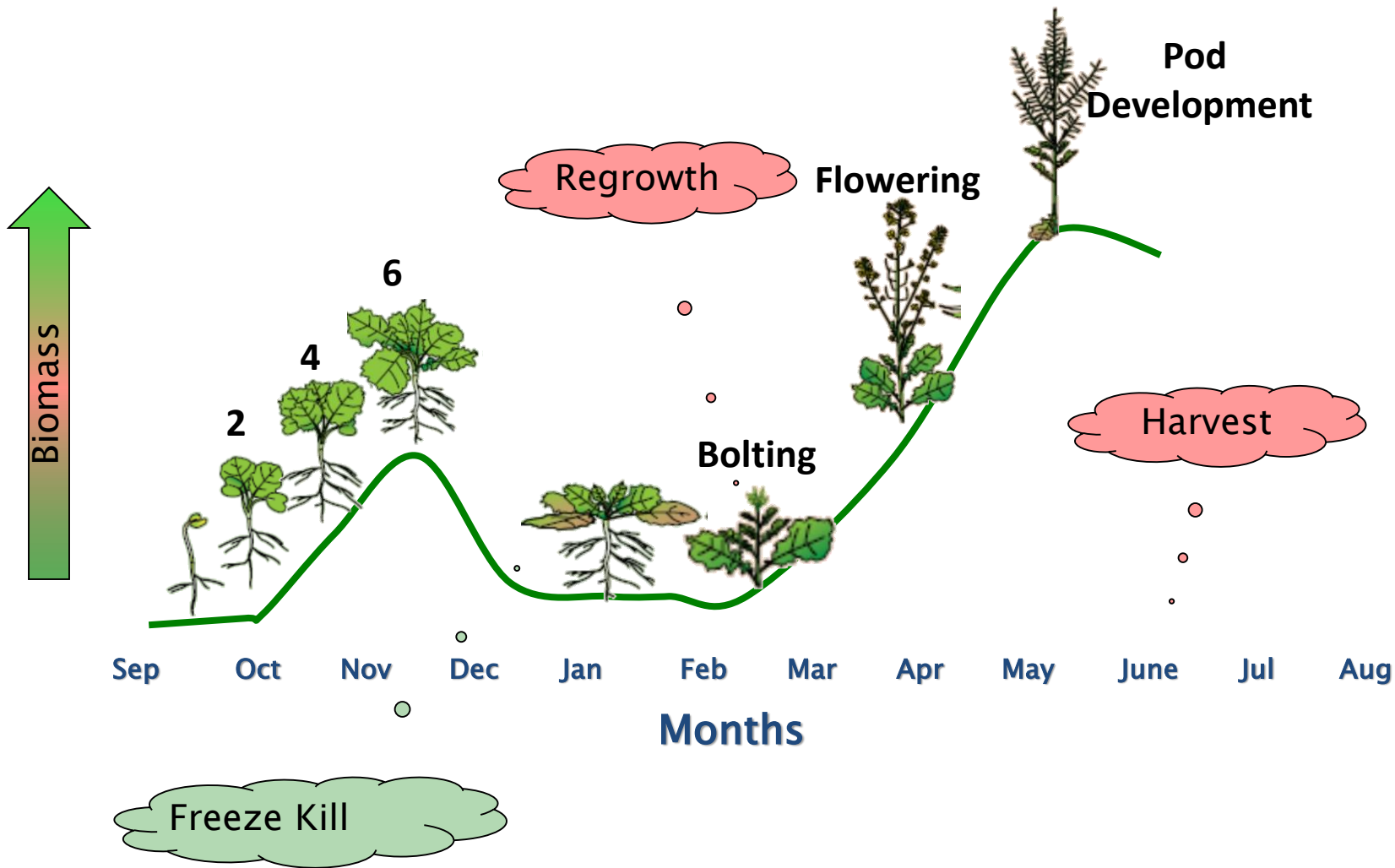
Sep Oct Nov Dec Jan Feb Mar Apr May June Jul Aug

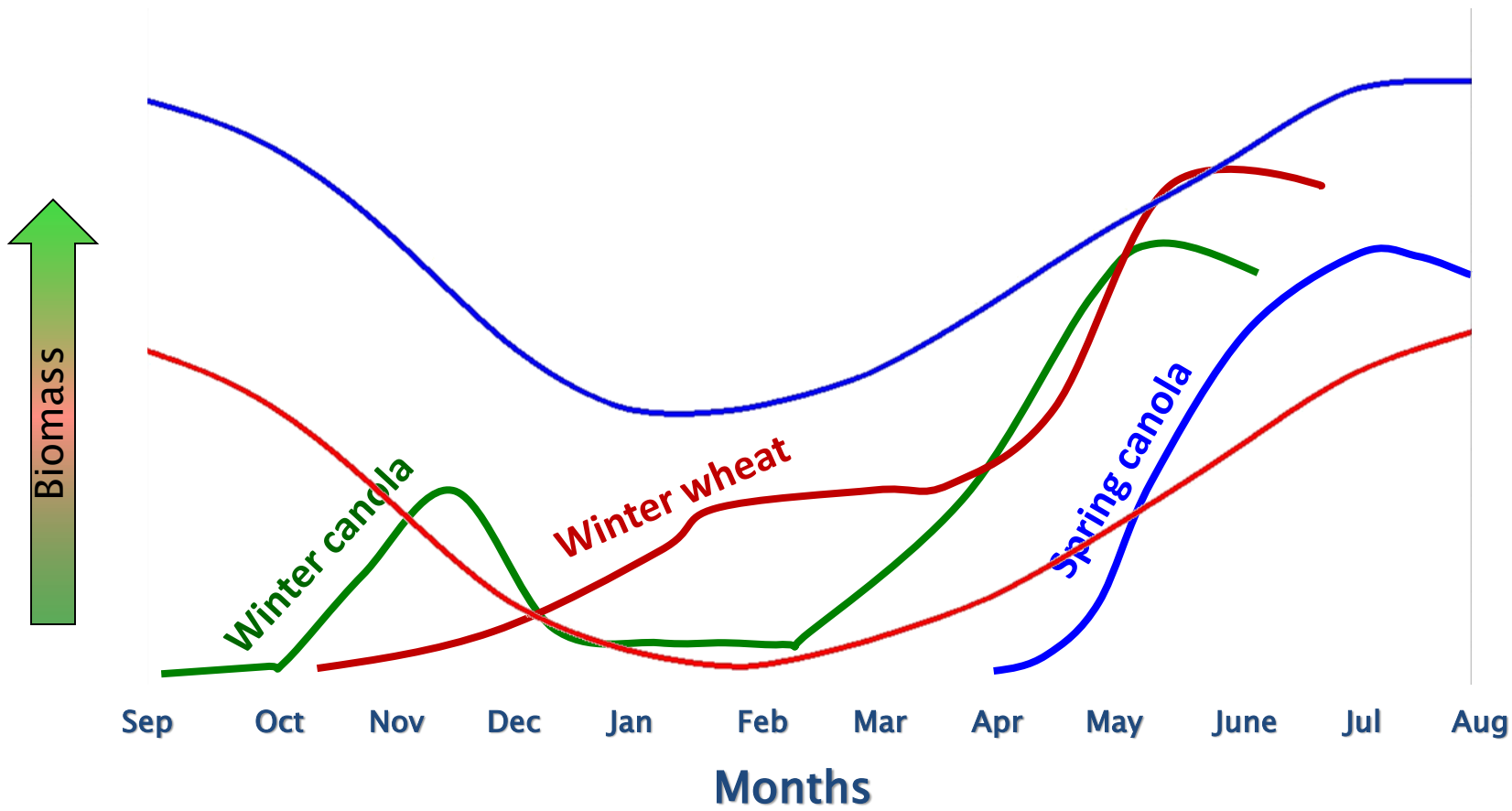
Months

Freeze Kill









Canola Benefits

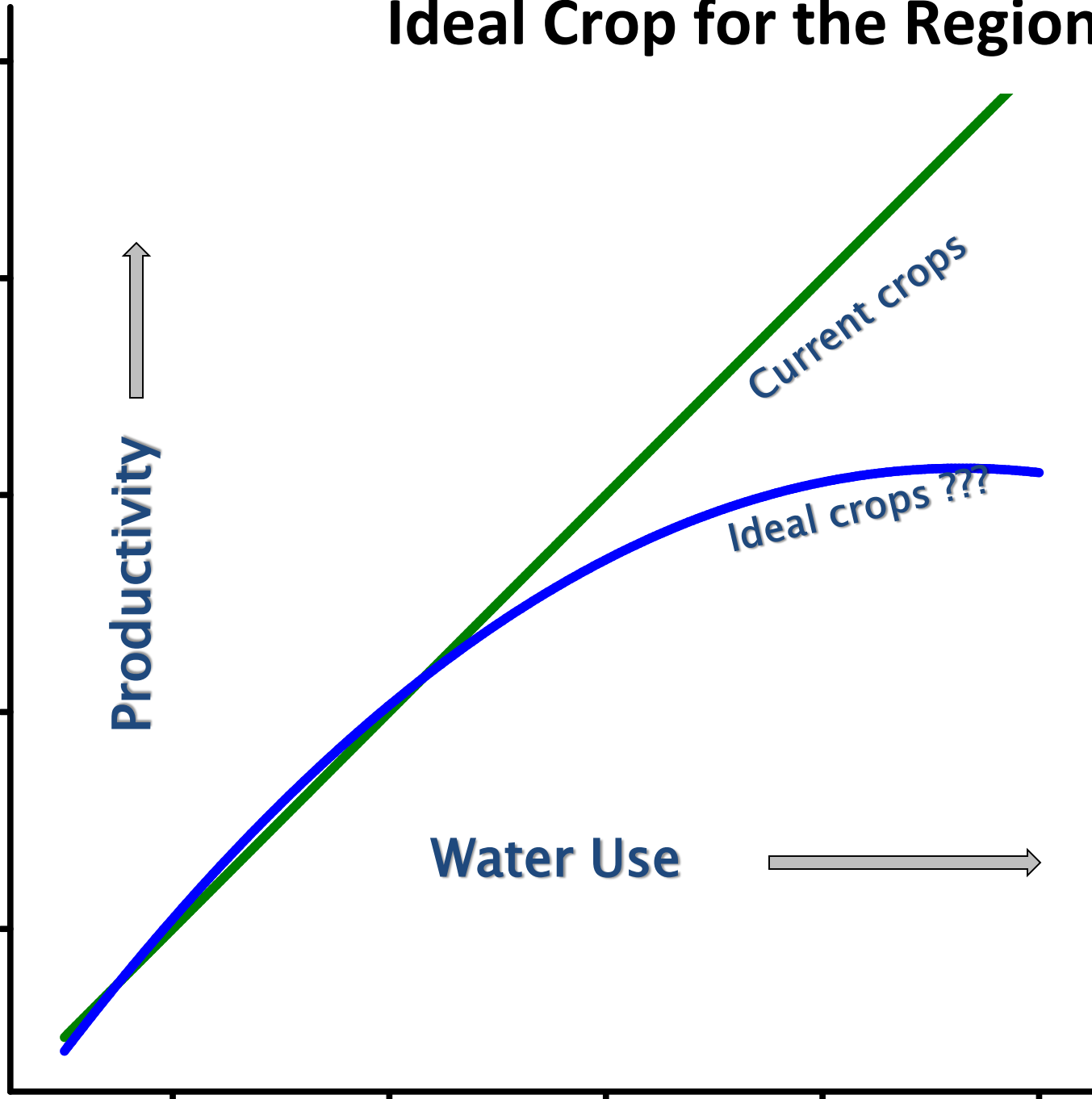
Ideal Crop for the Region

↑
Productivity

Water Use →

Current crops

Ideal crops ???



Wheat Yields



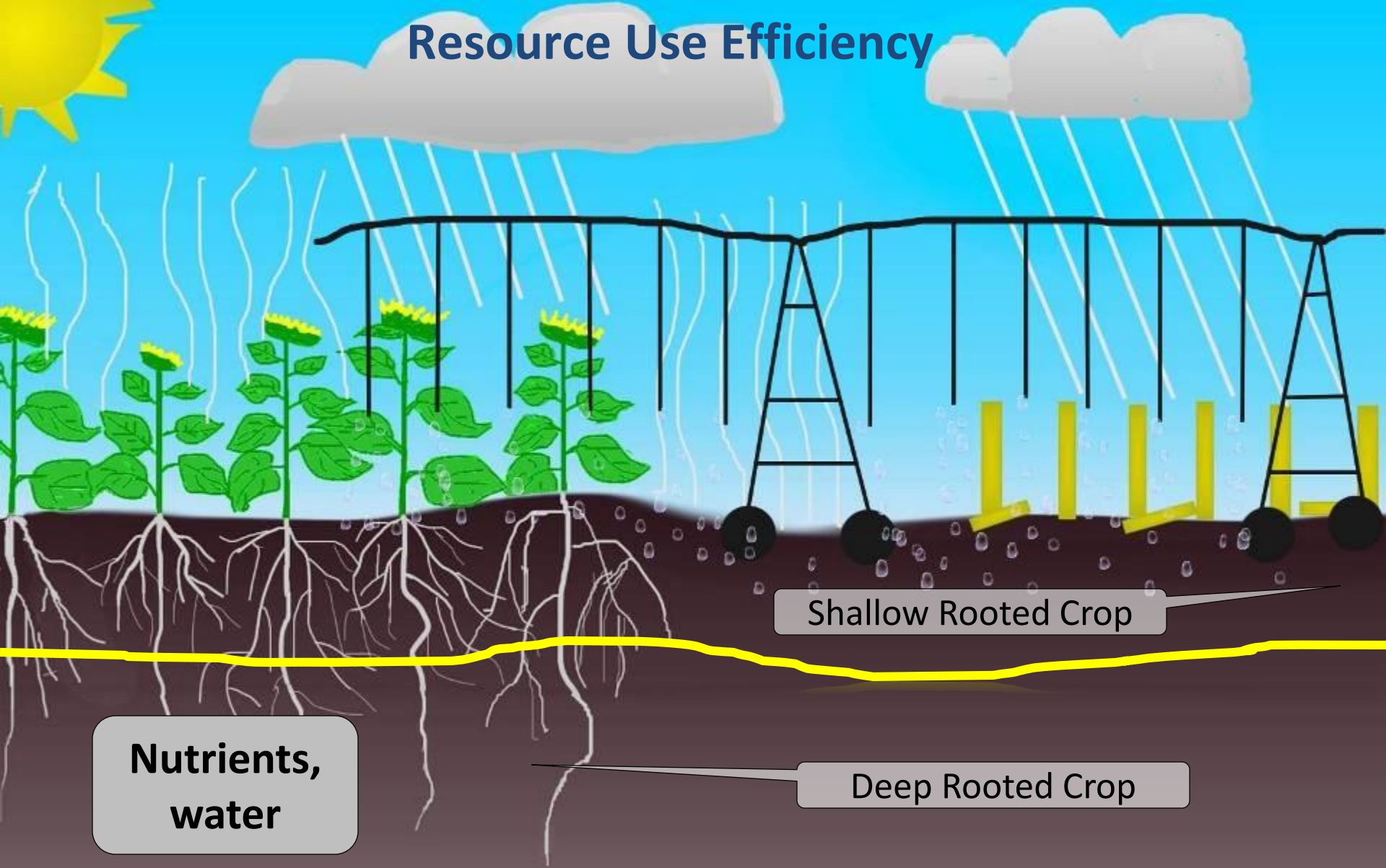
W-W 10bu/ac

C-W 25bu/ac

Same Planting Date, Variety, and Fertility in the middle of the drought

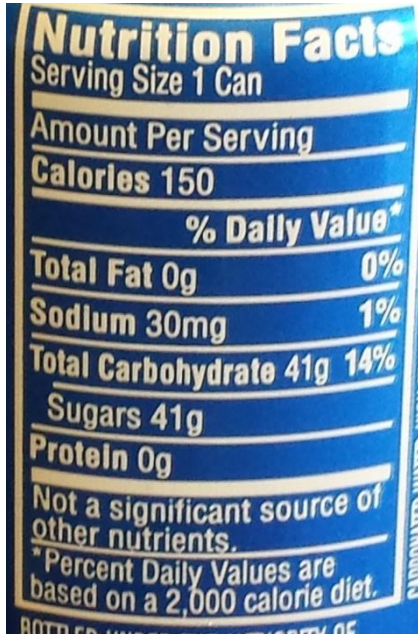
Canola makes wheat growers a better wheat formers- Heath Sanders- Canola Agronomist

Resource Use Efficiency



Multispecies cover cropping uses similar principle.

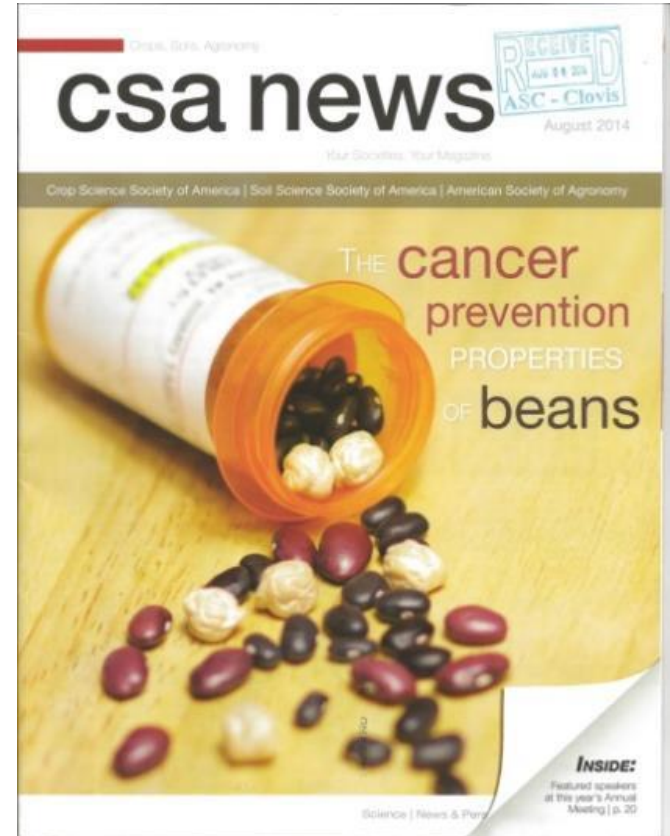
Changing Consumer Demand: Food for 'Energy, etc' vs. 'Nutrition, healthy living'



Nutrition Facts
Serving Size 1 Can
Amount Per Serving
Calories 150

	% Daily Value*
Total Fat 0g	0%
Sodium 30mg	1%
Total Carbohydrate 41g	14%
Sugars 41g	
Protein 0g	

Not a significant source of other nutrients.
*Percent Daily Values are based on a 2,000 calorie diet.



Healthy Oil

Honeybees on Canola 04/18/16



Alternative Biodiesel Crops



Canola



Sunflower



Seeds



Mustard



Camelina



Safflower

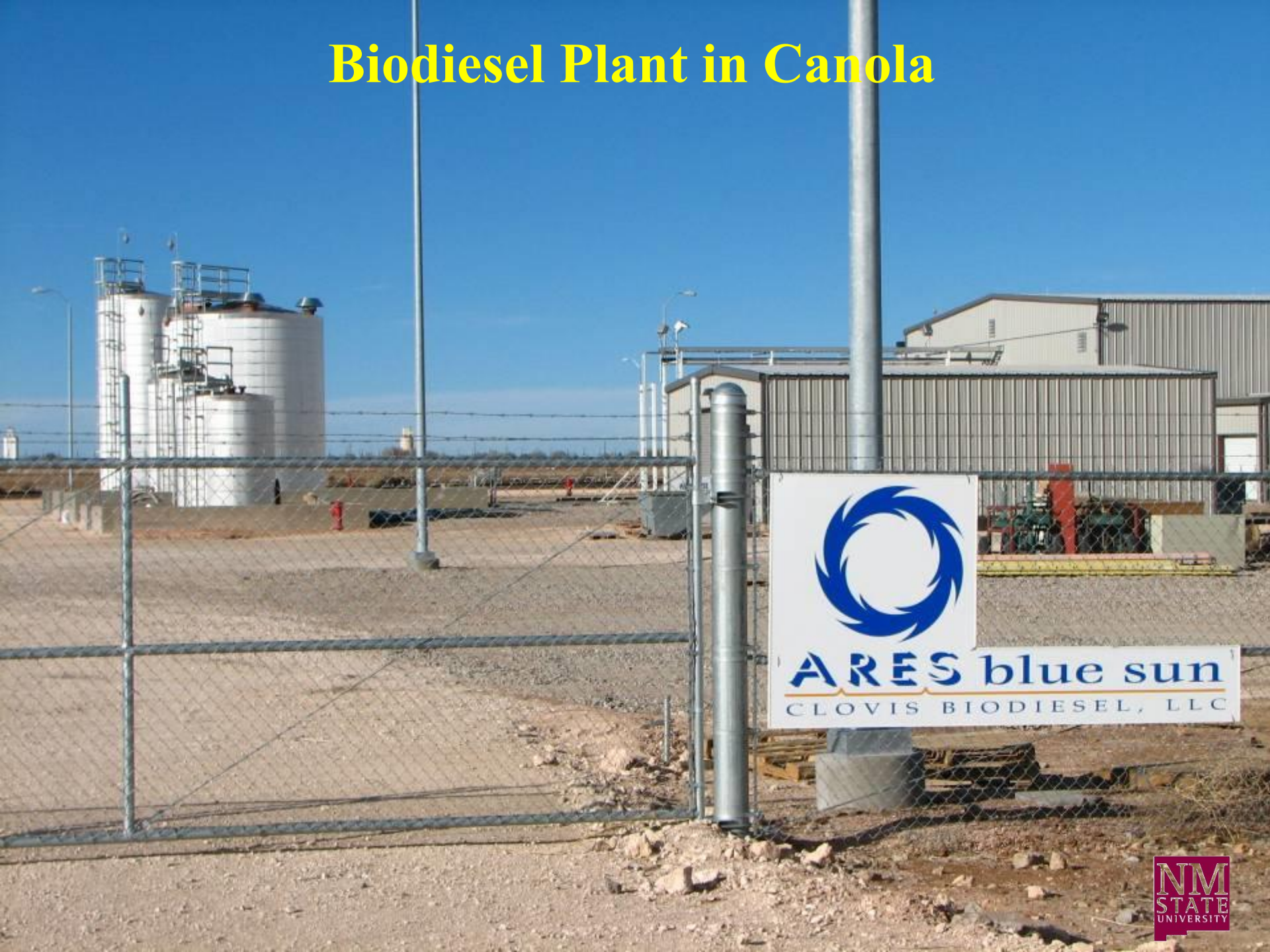


Glycerin



Protein supplement

Biodiesel Plant in Canola



UNITED STATES

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Canola Production

Canola Production

Processing

Canola Production

New Processing

Meal distribution to local dairies

Oil Export

Biodiesel Export

LEGEND

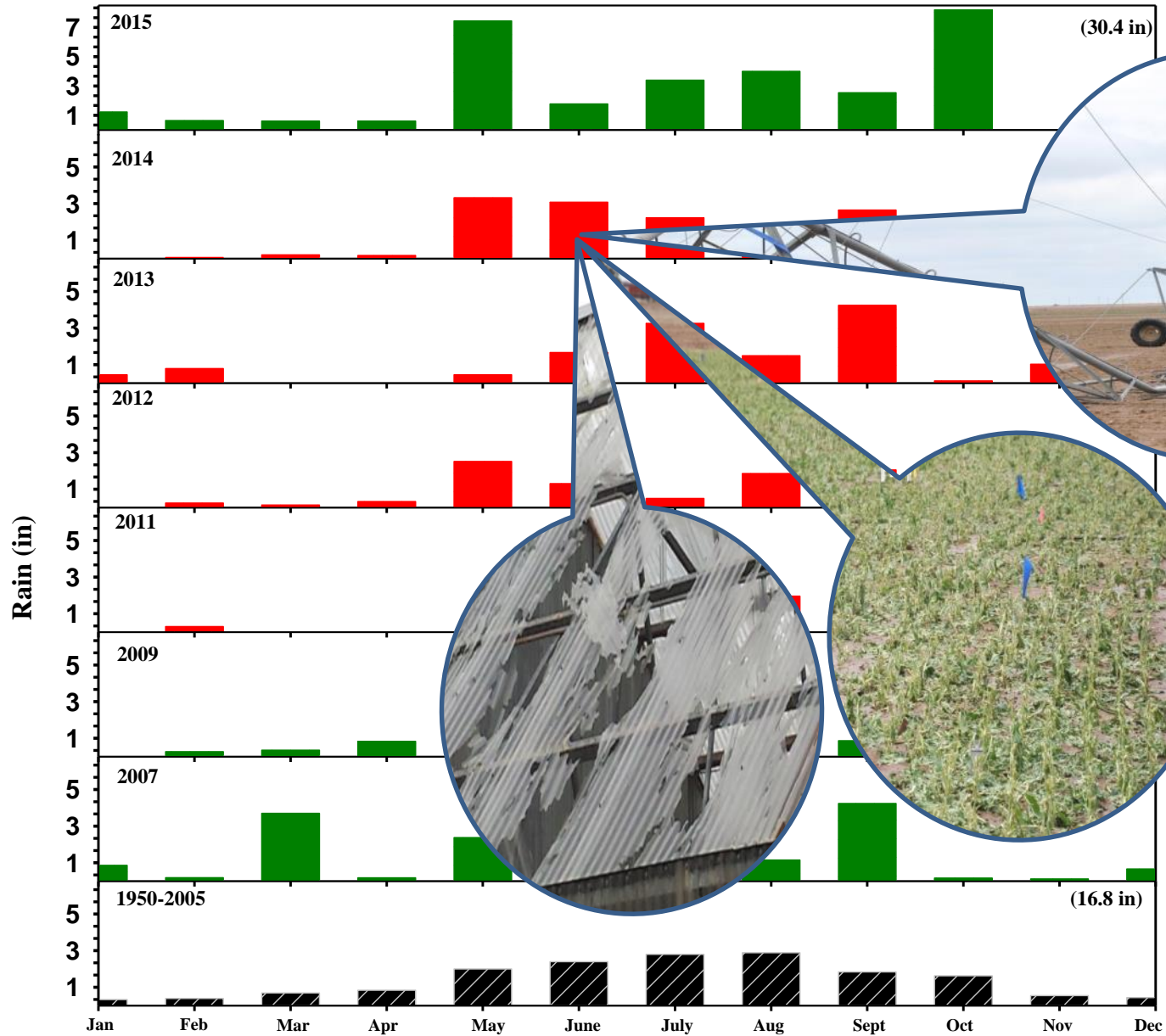
- Country Boundary
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Buffer Seasonal Extremes (Crop Diversity):
'Low and high rainfall', 'hail storm', 'wind storm', 'heat and freeze temperatures'

Clovis Monthly Rainfall



Hail Storm, Clovis (June 8, 2014)



Canola and Wheat at Harvest



**≈ 50% canola yield
(combined)**



Not harvested

Alternative Crops: Hail Damage



Corn: Hail damaged



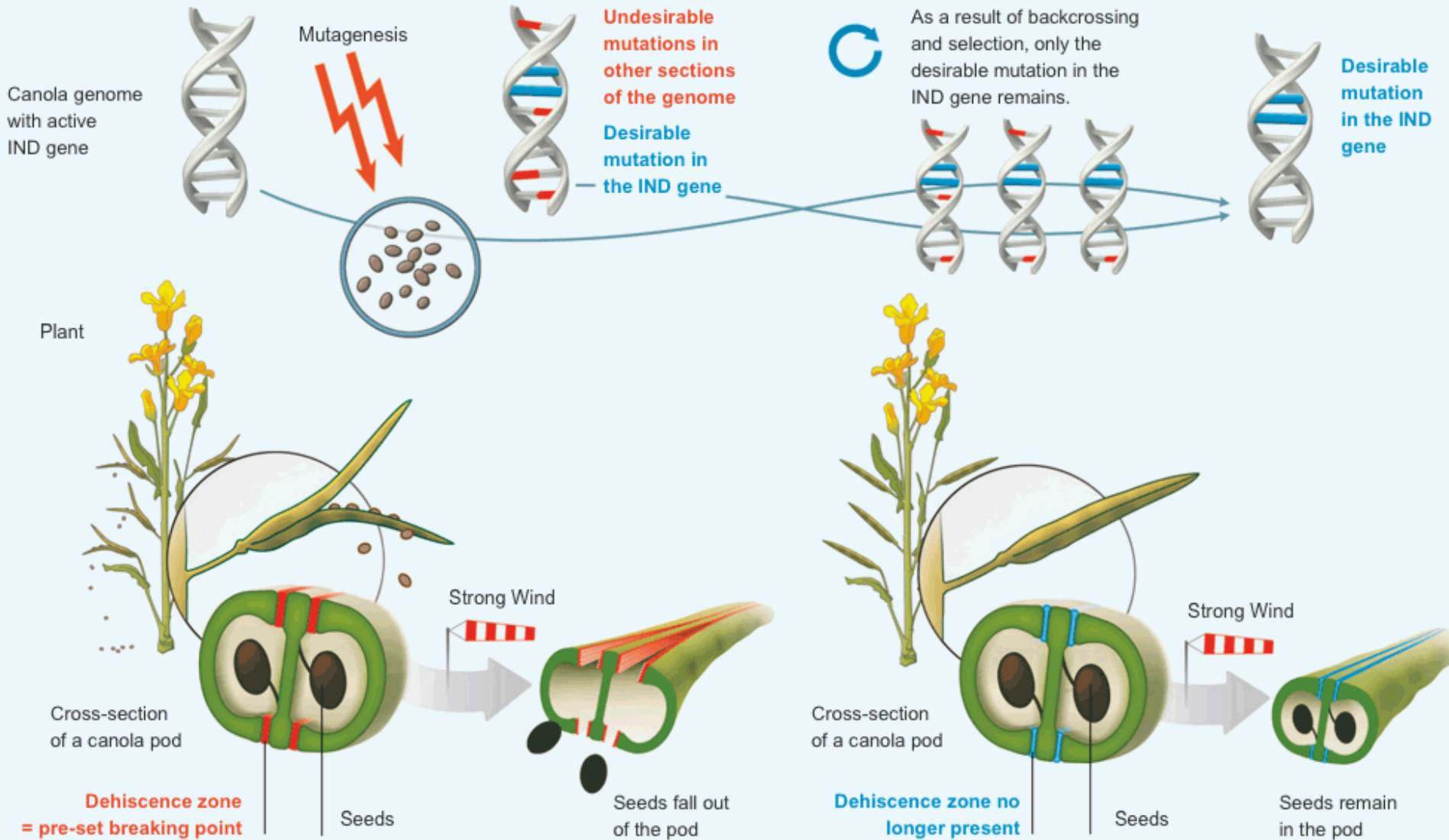
Safflower: Zero Hail damage



Canola: Hail damaged

(Clovis, 8/8/2012)

Non-shattering Canola



Canola Freeze Injury & Recovery



Late Spring Frost

(Mar 28, 09)



Freeze Injury

(Apr 17, 09)



Recovery

(Apr 30, 09)

(Clovis, NM)

Winter Canola Freeze Damage & Recovery



What are challenges of growing Canola?

- **Insects**
- **Weather**

Canola Flea Beetles



(Clovis 07)

Diamond Back Moth



Aphids



False Chinch Bug



(Clovis 09)

Thrips



(Clovis 08)

Harlequin Bug



(Clovis 09)

■ **Lessons Learned**

- ✿ **Winter Canola Variety Trial**
- ✿ **Winter Canola Irrigation Trial**
- ✿ **Dual Purpose Canola Production**

National Winter Canola Variety Trial

Season	# of Varieties	Seed Yield Range lb/ac	Average Yield lb/ac	Gross Income \$
2009-10	16	(3162-3799)	3643	546
2010-11	44	(608-2418)	1759	264
2011-12	45	(1563-3930)	2724	409
2012-13	50	(1680-3494)	2707	406
2013-14	47	(807-2061)	1271	191
2014-15	54	(2666-4641)	3811	572
2015-16	48	(1777-4477)	3548	532
2016-17	39	(928-1887)	1251	188

(7.50 \$/bushel used)

Winter Canola: Deficit Irrigation Management



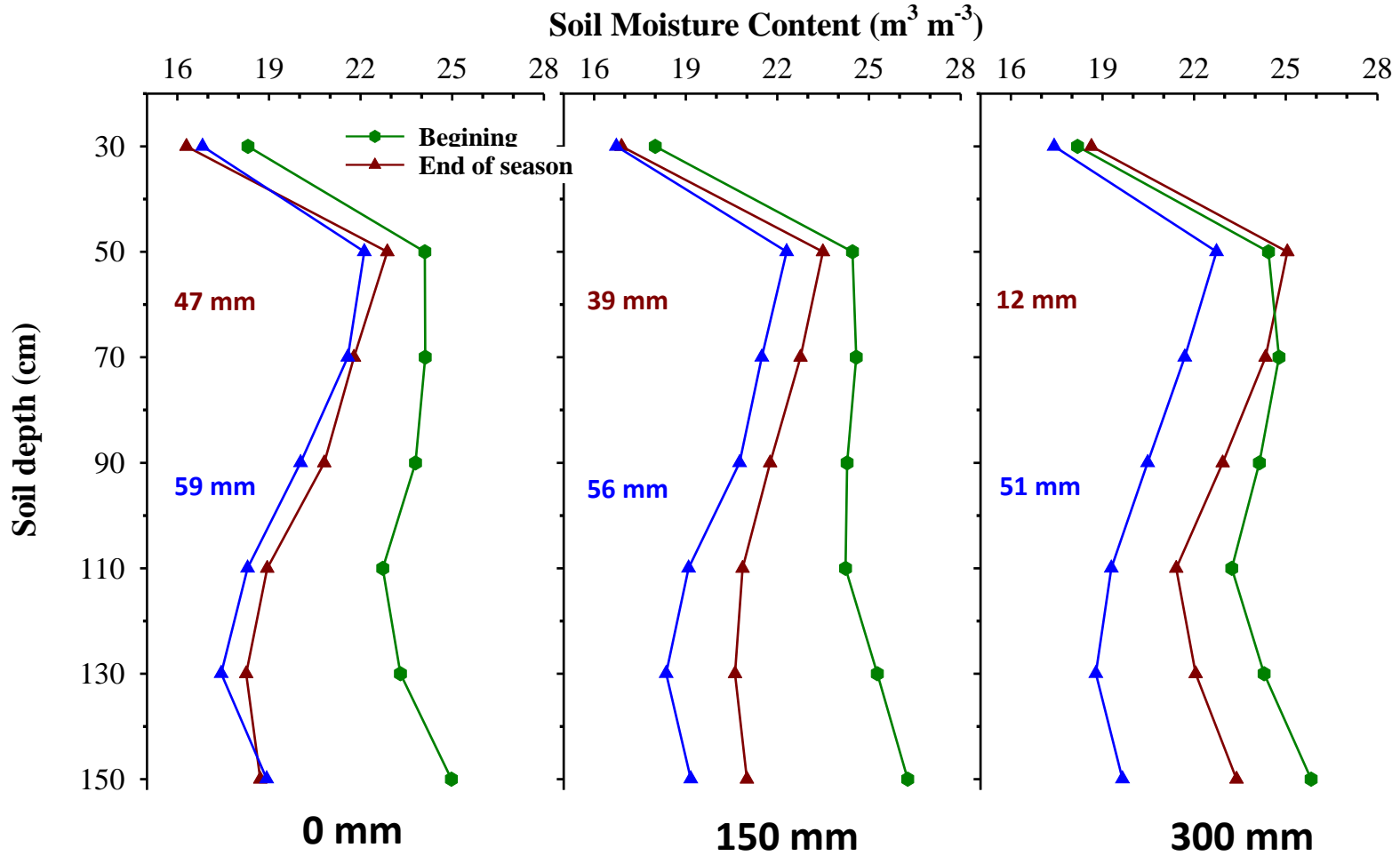
Winter Canola Root System and Water Needs



(Clovis, 2014)

Water Extraction

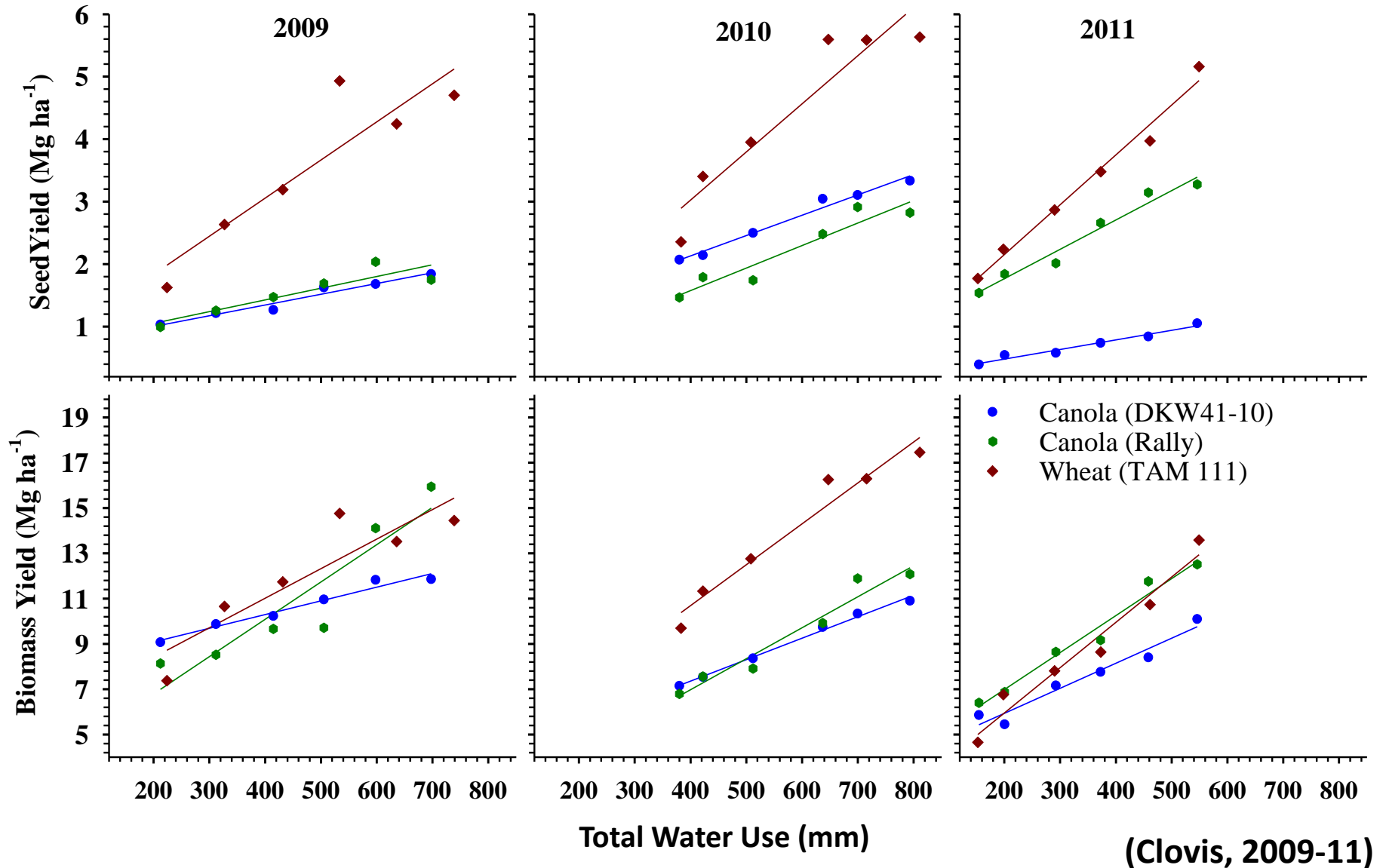
(Winter Canola & Wheat)



(Clovis, 2009)

Water Use and Forage Production

By Winter Canola & Wheat

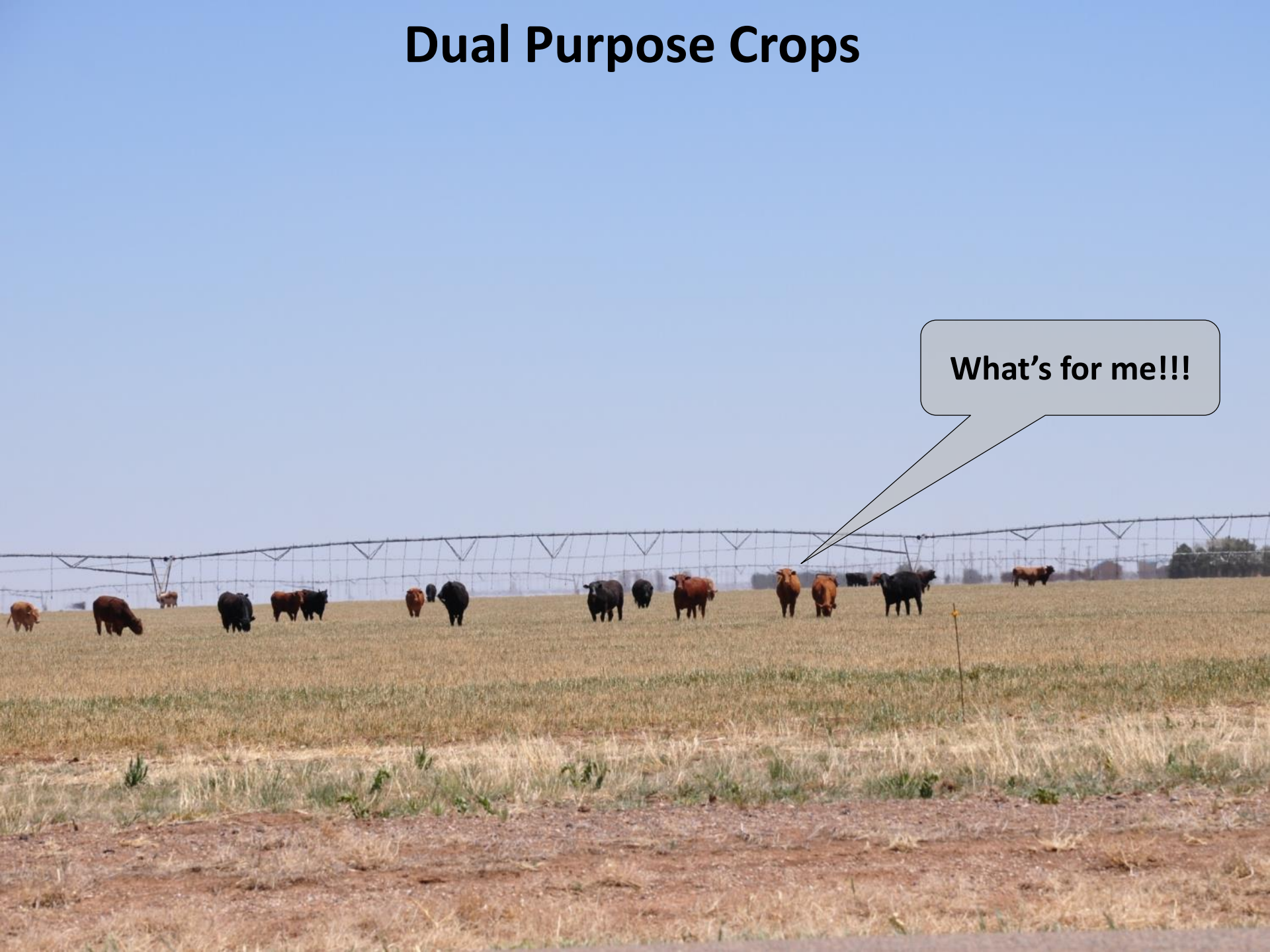


(Clovis, 2009-11)

Winter Canola Variety Critical Stage Based Irrigation Trial

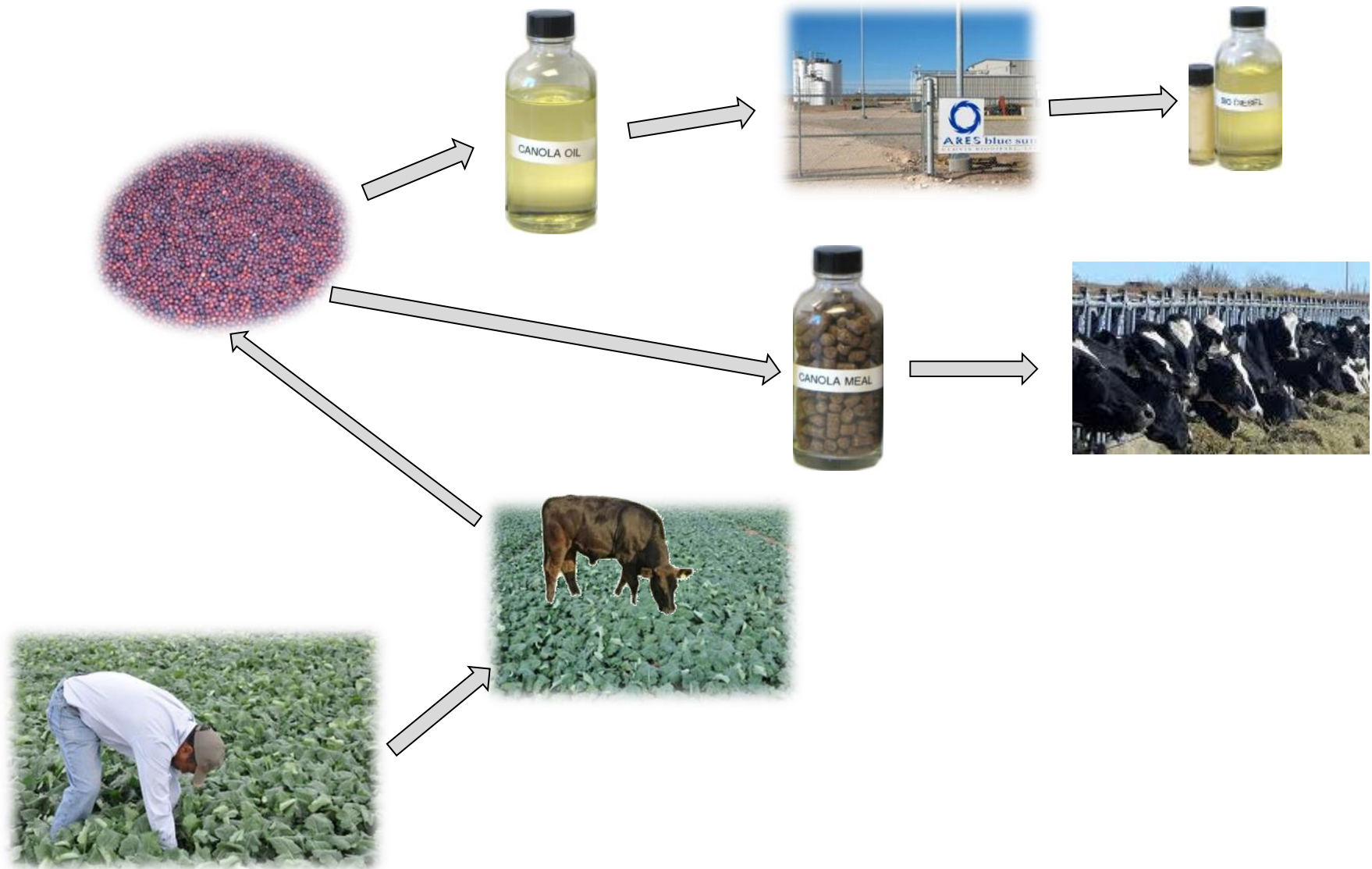
Pre-Season Irrigation	Critical Stage Irrigation	Seed Yield lbs/ac	Pods/Plant	Seeds/pod	1000 Seed Weight (g)
Pre-season	Irrigated	1863	102	16	4.38
	Vegetative Stress	1787	85	12	4.50
	Reproductive Stress	1252	82	13	4.51
	Rainfed	931	58	10	4.57
No-Pre-season	Irrigated	1616	127	16	4.38
	Vegetative Stress	1136	75	12	4.74
	Reproductive Stress	852	62	13	4.37
	Rainfed	513	39	9	4.64

Dual Purpose Crops



What's for me!!!

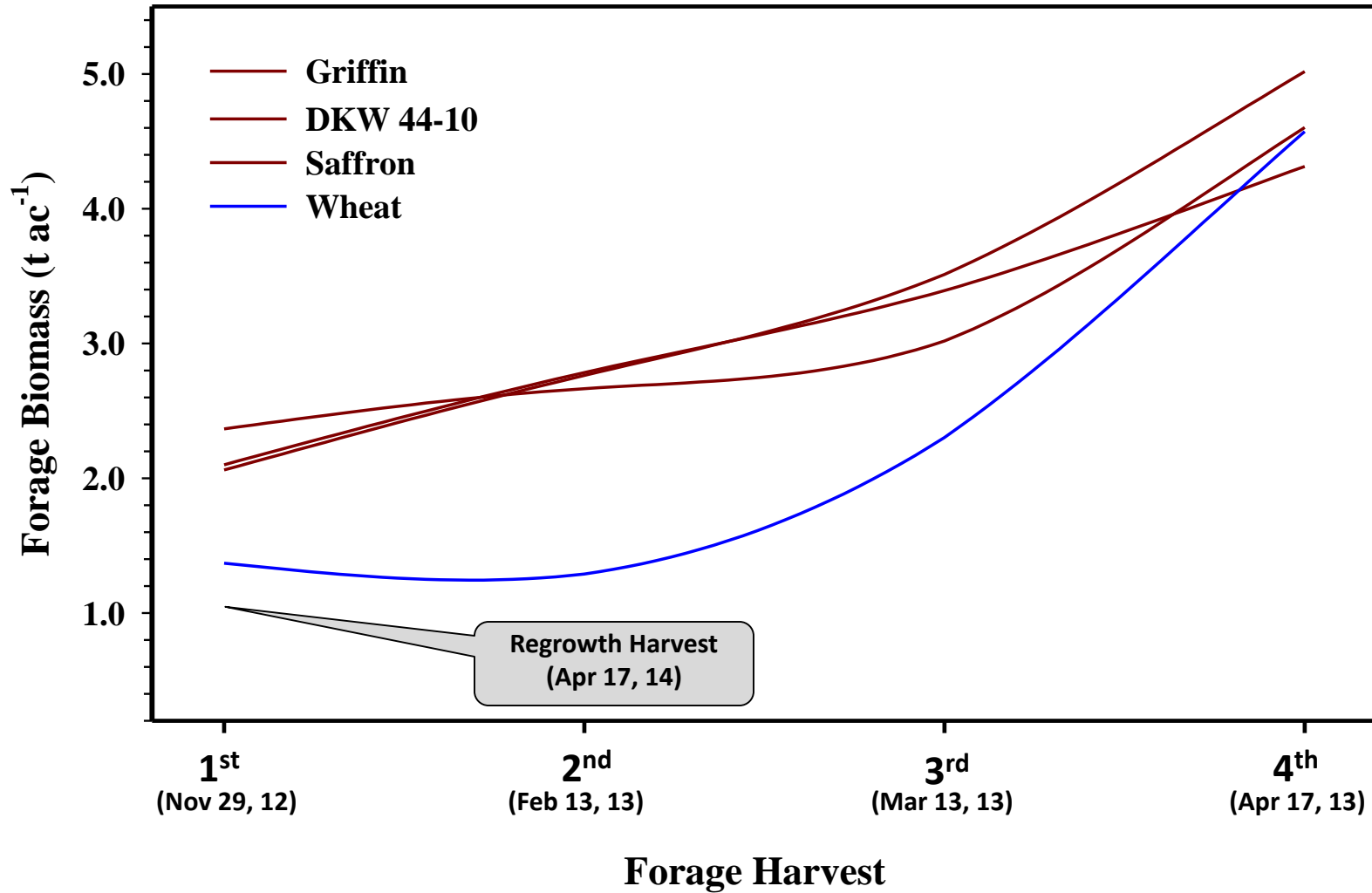
Dual Purpose Canola



Australian Dual Purpose Canola

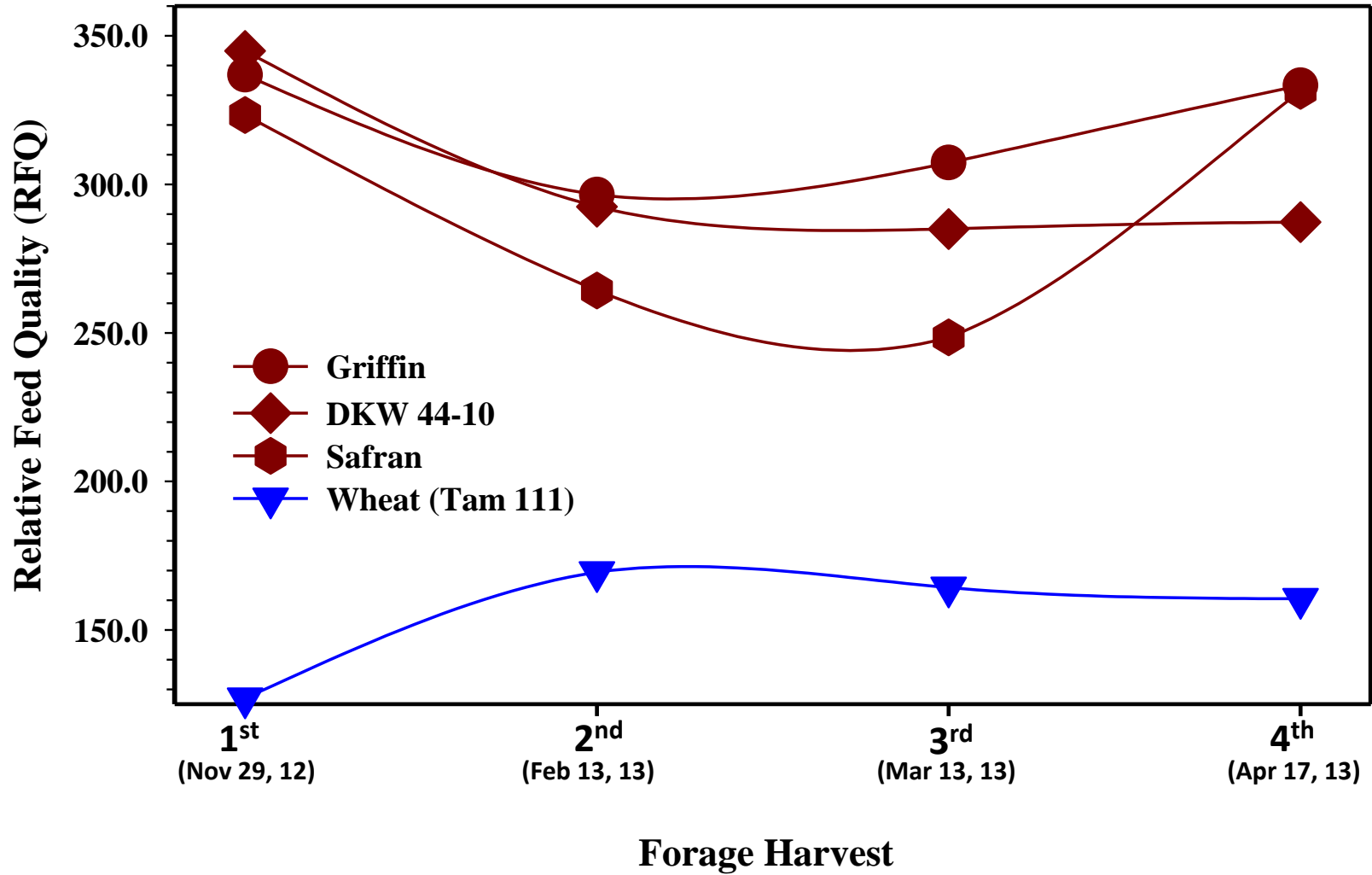


Forage Productivity



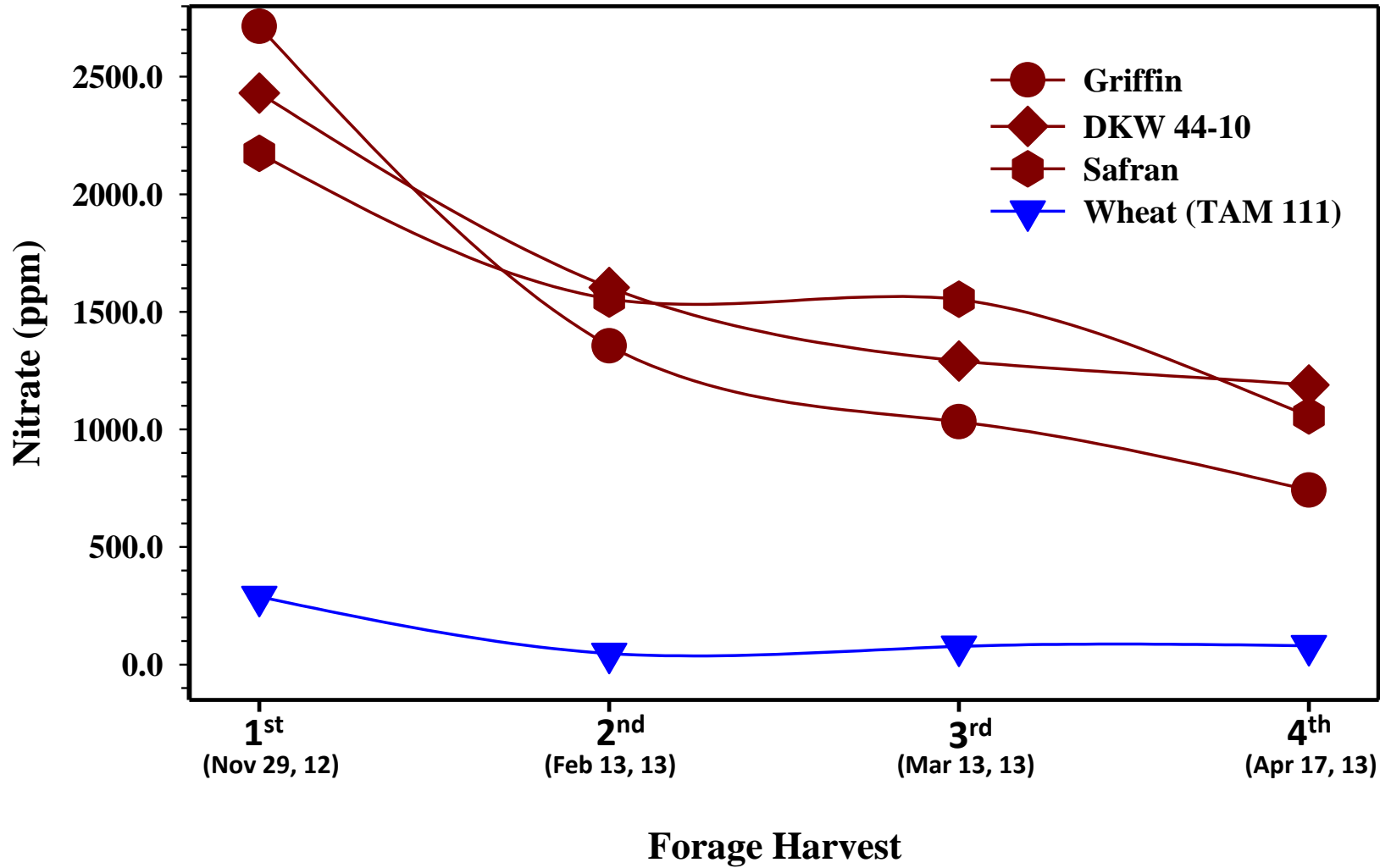
(Clovis, 2012-13)

Forage Quality



(Clovis, 2012-13)

Forage Nitrate Content



(Clovis, 2012-13)

Canola for Silage, Clovis 2016



Farmer's field near Melrose (3/24/16)

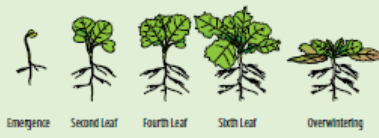


Conclusions

- **Declining resources and increasing uncertainty are creating an opportunity to assess alternative crops and cropping systems in the region.**
- **Crop diversity will be the need of the future.**
- **Changing consumer needs will be a major player in adoption of alternative crops.**

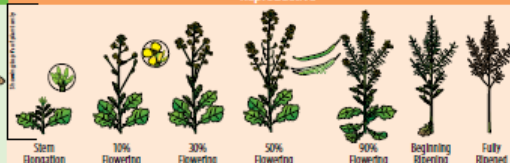
Winter Canola Literature

Vegetative



Emergence Second Leaf Fourth Leaf Sixth Leaf Overwintering

Reproductive



Stem Elongation 10% Flowering 30% Flowering 50% Flowering 90% Flowering Beginning Ripening Fully Ripened

Canola Development Stages

Emergence
The hypocotyl pulls the cotyledons above the soil surface. The growing point is between the two cotyledons. The taproot grows vertically and the secondary roots and root hairs grow, capturing water and nutrients.
Management: Insecticide-treated seed protects against flea beetle, green peach aphid, and turnip aphid. Consider spraying the field margins for grasshoppers. Fungicide-treated seed protects against damping off and seed-borne blackleg but does not protect against blackleg from crop residue.

Second leaf
Two leaves fully expanded. The rate of leaf expansion is 7 to 10 days per leaf. Rapid canopy establishment improves light, water, and nutrient capture.
Management: Scout for insects, weeds, and diseases. Watch for shot holes and windburn from diamondback moth and armyworm larvae feeding and for blackleg lesions on leaves. Control annual broadleaf and grassy weeds.

Fourth leaf
Four leaves fully expanded. The total number of leaves a plant produces depends on factors such as genotype, planting date, seedling rate, nutrient, temperature, and moisture.
Management: Complete weed control by 4 to 6 weeks after emergence. Include a foliar insecticide with the herbicide if needed. Apply a foliar fungicide if blackleg lesions are present.

Sixth leaf
Six leaves fully expanded. This is the minimum number of leaves needed before dormancy. Canola may produce 10 to 13 leaves on the main stem. The end of leaf development coincides with vernalization.
Management: Continue scouting for blackleg lesions. Nutrient and water demands increase until the overwintering stage.

Overwintering
Canola overwinters in the rosette stage. The stem thickers. The plant produces smaller leaf cells with a higher concentration of soluble substances, increasing freeze tolerance.
Management: Apply nitrogen in a split approach, with a quarter to a third applied preplant and the remainder top-dressed at spring greenup. Sulfur is also critical and can be applied in the fall or with the nitrogen top-dress. Apply herbicides as the plant resumes growth in the spring. Scout for army cutworm.

Roots
Canola is a tap-rooted crop with many lateral, fibrous roots. These roots have a mellowing effect on soil structure. For all subsequent growth stages, only the top two-thirds of the plant is illustrated.

Stem elongation
Growth resumes when days lengthen and average temperatures reach 40 degrees Fahrenheit. Stem elongation (bolting) begins with leaf expansion and the initiation of flower buds. In the axils of the upper leaves, branches form from buds. Each branch develops one to four leaves and a flower bud cluster. Fifteen to 20 leaves develop.
Management: Nutrient demand increases significantly and the plant is moderately tolerant to hard freezes at this stage.

10% Flowering
10 percent of the flowers are open. Flowering begins when the first flower opens, usually on the lowest bush on the main stem and continuing upward, with three or more flowers opening each day. Secondary branches begin flowering 2 to 3 days later.
Management: Drought and heat may limit branching and reduce yield. Freezing temperatures affect open buds. Damage can be observed as a bend in the inflorescence and aborted flowers.

30% Flowering
30 percent of the flowers are open. Seeds per pod are defined once the flower is open. A reduction in photosynthetic capacity can cause flower abortion, reducing potential pods and seeds per pod. About 50 percent of open flowers become productive pods.
Management: Evaluate the risk for sclerotinia stem rot, especially if the field or neighboring fields have a history of canola. Fungicide applications should be made at 30 to 50 percent flowering to control sclerotinia.

50% Flowering
50 percent of the flowers are open. Flowers that opened in the first 30 days and were successfully pollinated are forming pods and seeds. Flowering usually lasts 30 to 40 days. A healthy pod canopy is critical for seed development. Maximum plant height is attained.
Management: Several flowers can be lost due to stress conditions and the plant can still recover if leaf, stem, and pod areas remain undamaged as conditions improve. Scout for insect pests that feed on flowers and pods.

90% Flowering
90 percent of the flowers are open. Active seed formation is progressing in early formed pods, and main pods are developing. Competition for resources between opening flowers and pods interrupts flowering. Pods are expanding rapidly, reaching maximum fresh weight and length by the mid-point of grain fill.
Management: Powdery mildew and Alternaria spp. may reduce pod and seed set if wet conditions are prevalent at late flowering/early pod filling. Foliar fungicides may be applied.

Beginning ripening
This occurs when the pods turn from yellow to brown, becoming brittle as they dry. Seed color and coat are changing and drying out. Grain filling typically lasts 35 to 55 days. Maximum seed dry weight is reached at 70 days after flowering. Seed moisture is lost at roughly 2 to 3 percent per day.
Management: Manage harvest operations. Swathing may occur between 30 to 60 percent of seed color change. Decays may be applied to Tasson dry down color change.

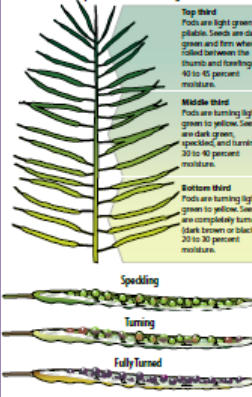
Fully ripened
Seeds are mature and losing moisture, and final seed weight has been achieved. All pods have reached maturity and are split easily along the center membrane.
Management: Harvest should occur at 8 to 15 percent seed moisture. Begin harvest as soon as the crop is fully ripened. Canola seed can be window ripens in 4 to 12 days.

Pod and Seed Development Timeline

Specific results are environment and cultivar dependent

- Day 1** - First buds open and fertilization of the ovule occurs.
- Day 15** - Seed expansion begins; seeds are watery and translucent.
- Day 30** - Pods nearing full length; seed fill begins with rapid embryo growth and protein accumulation.
- Days 35 to 55** - Seed oil synthesis.
- Day 40** - Maximum pod fresh weight and length achieved. Seed development complete at 55% of mature dry weight.
- Days 50 to 72** - Pod walls reach maximum fresh weight and seed moisture loss begins.
- Day 60** - Seed oil synthesis complete at 40% seed color change. Seed is 70% of final dry weight.
- Day 65** - 60% seed color change.
- Day 70** - Seeds reach maximum dry weight.
- Day 80** - Pods and seeds fully ripened.

50 percent seed color change on the main stem



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Great Plains Canola Production Handbook



Oklahoma State University • Kansas State University • University of Nebraska
June 2012

Temperature Extremes: Cold!!!

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