



The influence of harvest time on levels of bioactive compounds in sea buckthorn berries *Hippophaë rhamnoides* L. *ssp. sinensis*

Susan St. George, Stefan Cenkowski
Biosystems Engineering, University of Manitoba
Prepared for: 3rd ISA Conference 2007
Quebec City, Quebec August 12-16, 2007

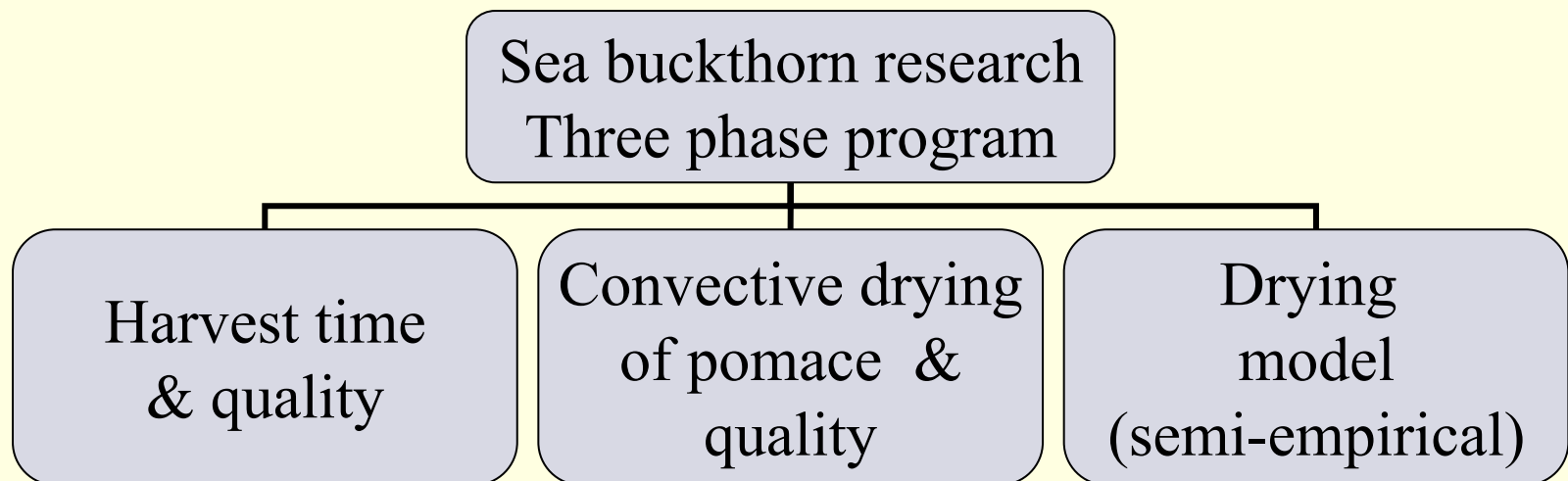
Let food be thy medicine

Hippocrates, 400 BC

Evidence that certain bioactive compounds can offer health benefits in the prevention and treatment of degenerative diseases



The research program





The research objective – Phase I

To determine if *harvest time* has a significant effect upon bioactive compounds and physical properties of the fruit and seed components of sea buckthorn berries (*Hippophaë rhamnoides* L. ssp. *sinensis*).

harvest time determined by maturity, temperature and climatic conditions

Sea buckthorn – The berry



- Bioactivity
- Diversification crop
- Challenging to harvest

The purpose of this research

Characteristics & Quality

- Onset of maturity
 - September
- Maturity
 - November
 - 1st severe frost
- Post-maturity
 - January
 - Temperatures $< -20^{\circ}\text{C}$

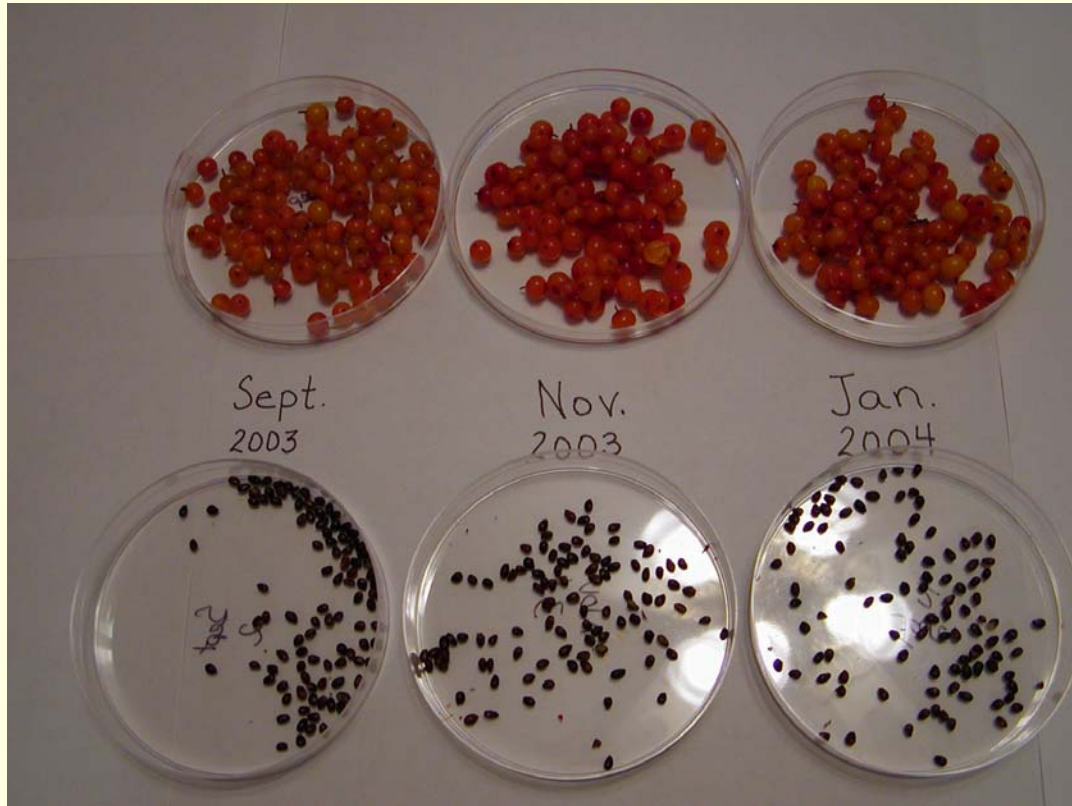


Methods - Harvest



- Sea Buckthorn berries (*H. rhamnoides* L. ssp. *sinensis*)
- Branching Out Orchards St. Claude, MB
- Manual harvesting from twenty shrubs
- 2003/04 harvest year
September, November,
January

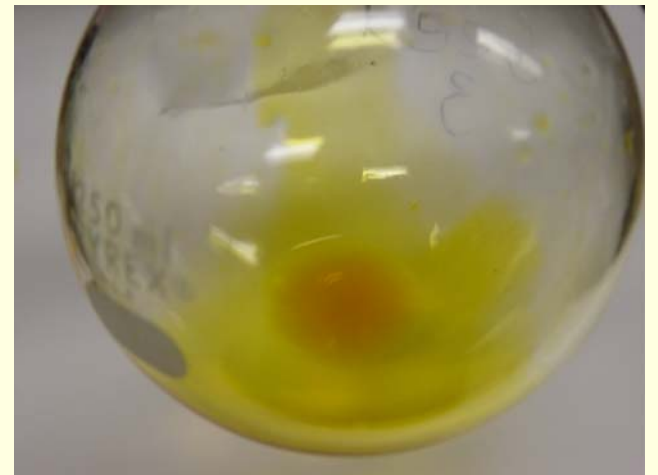
Methods – Physical property testing



- Moisture content
% w/w wb
- Berry and seed size
g % berries
- Seed content
g % seeds
- Colour analysis
(CIELab Scale)
L, a*, b**

Methods – Bioactive testing

- Levels of compounds in fruit (pulp, peel, juice) and seed oils
 - fatty acids, % w/w
 - carotenoids, *mg / 100 g oil*
 - tocopherols and tocotrienols, % w/w and *mg / 100 g oil*
 - phytosterols *mg / 100 g oil*



Results – Physical properties

Significant ($p < 0.05$)*

Berry size, g%

(Sept. vs Nov., Jan.)

Seed content, w/w %

(all levels)

Colour, L^* , a^* , and b^*

a^* (all levels)

L^* , b^* (Jan. vs Sept., Nov)

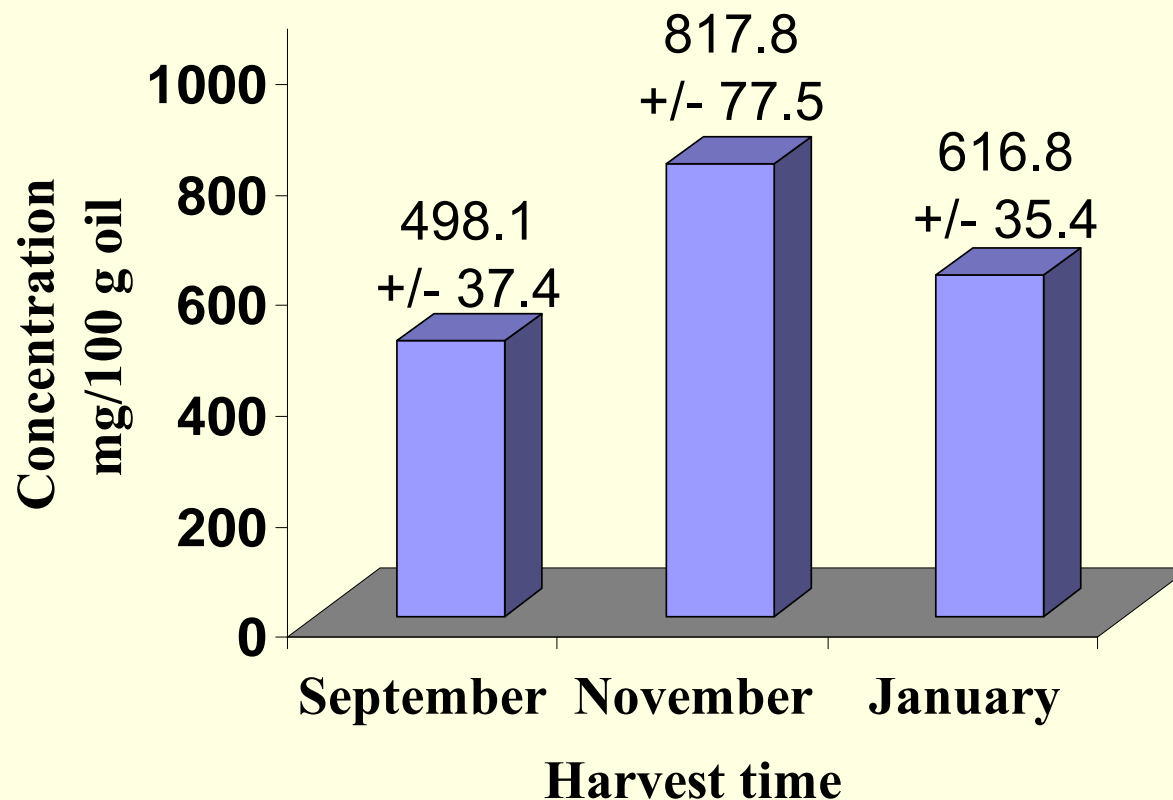
Non-significant ($p > 0.05$)*

Moisture content, w/w %

Seed size, g%

*(Tukey-Kramer HSD)

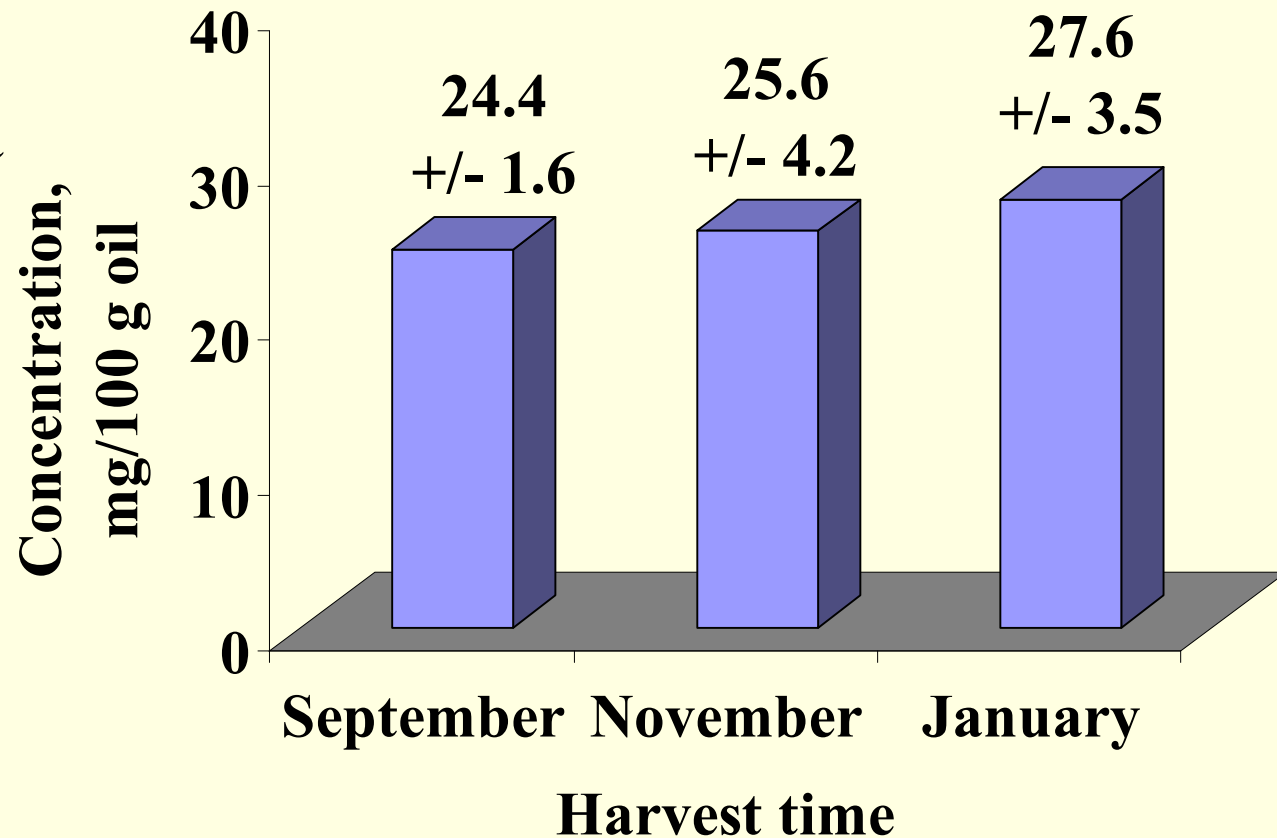
Results – Bioactive testing (carotenoids in fruit oil)



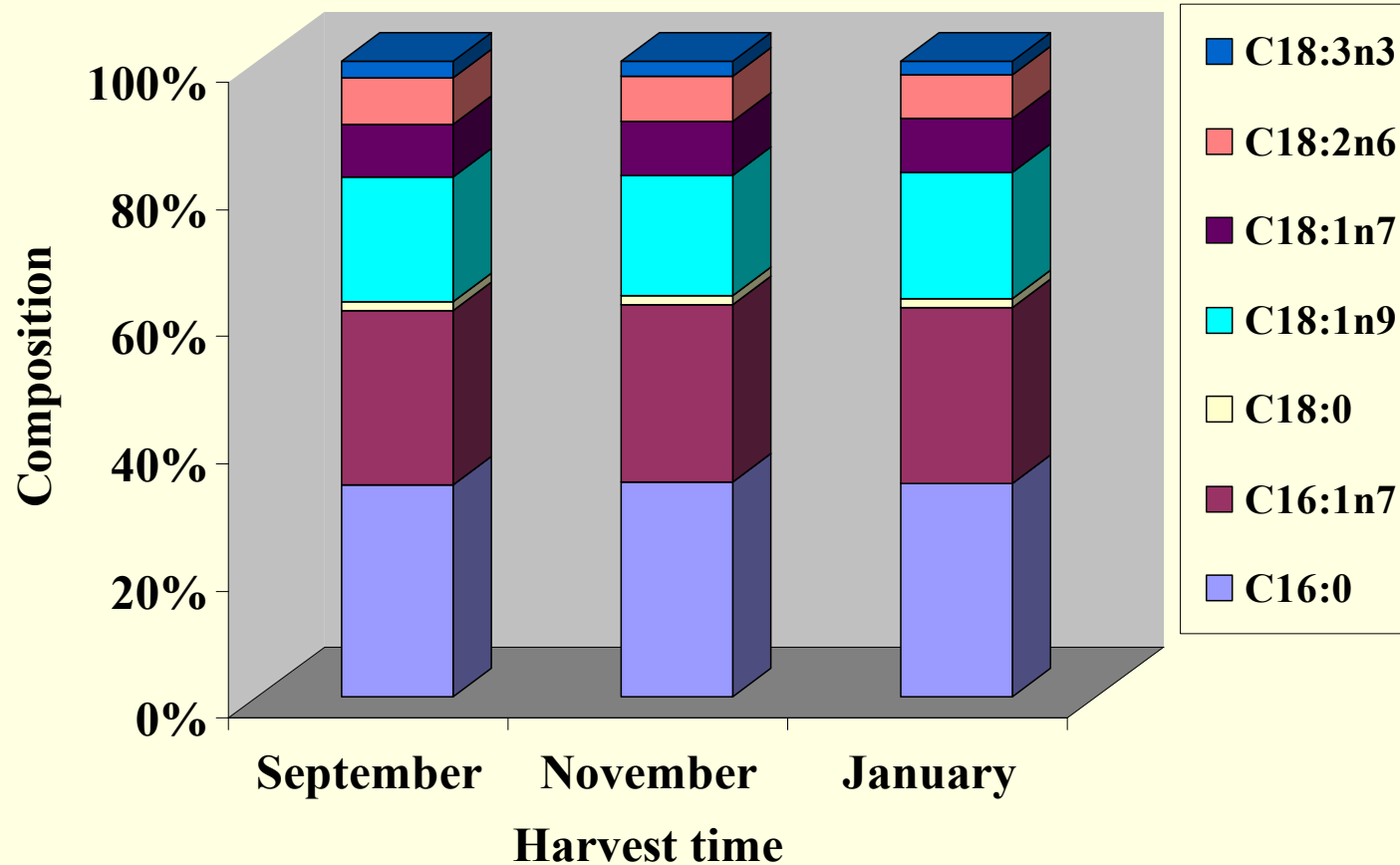
Harvest time has a significant effect on total carotenoid levels in fruit oil ($p < 0.05$).

Results – Bioactive testing (carotenoids in seed oil)

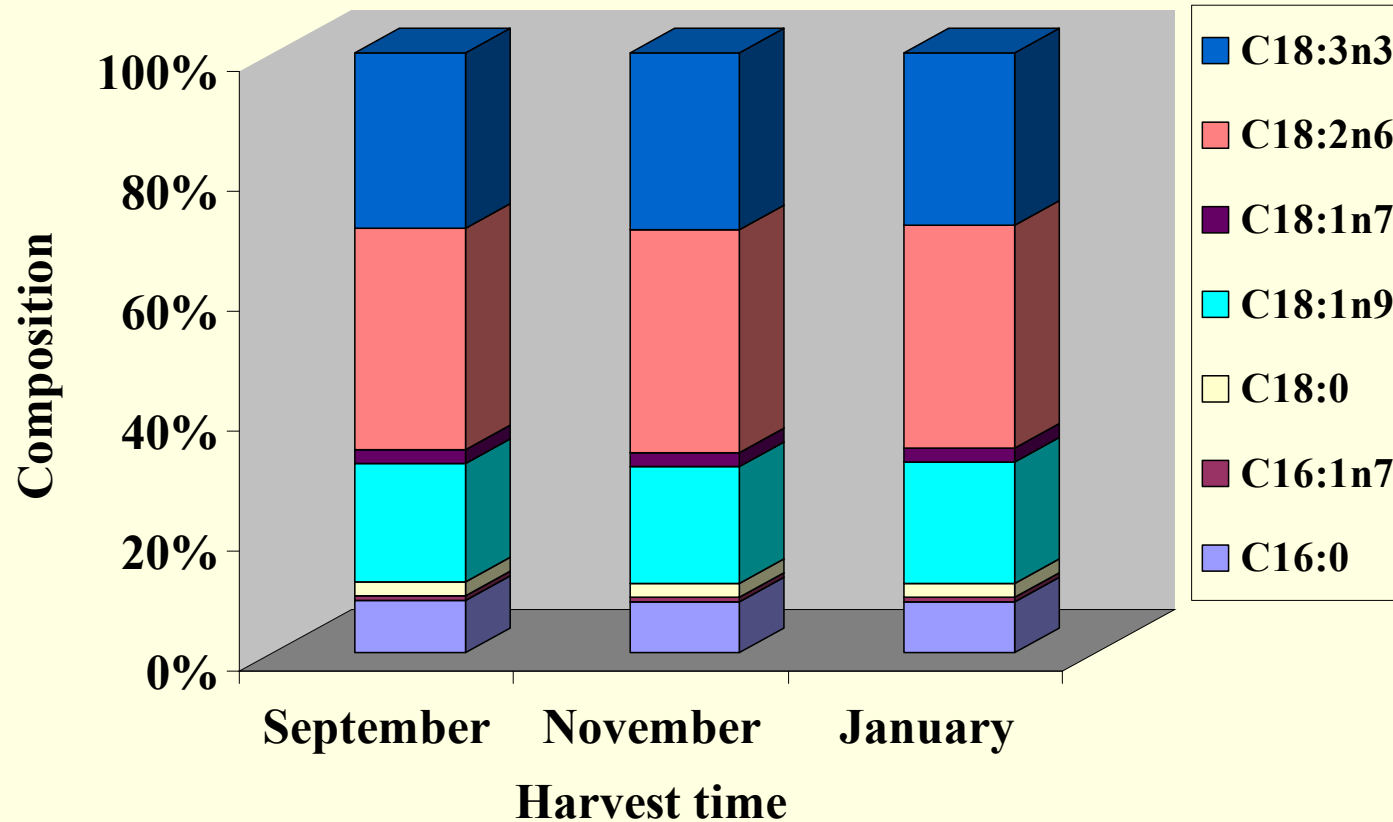
Harvest time does not have a significant effect on total carotenoid levels in seed oil ($p > 0.05$).



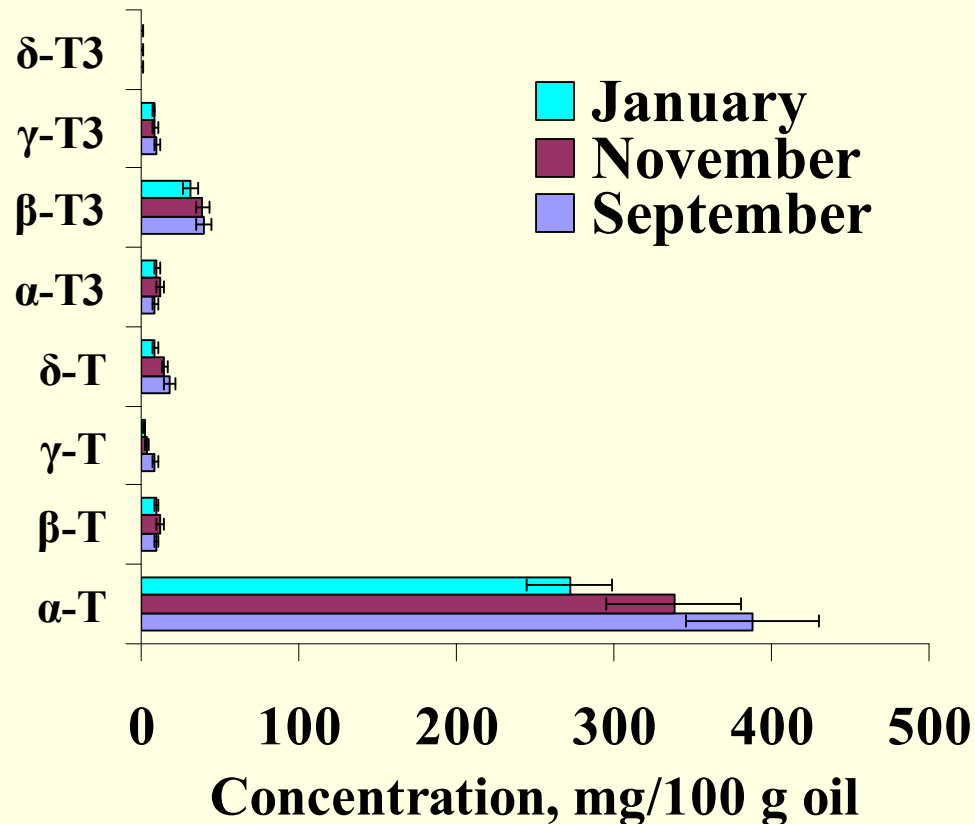
Results – Bioactive testing (fatty acids in fruit oil)



Results – Bioactive testing (fatty acids in seed oil)



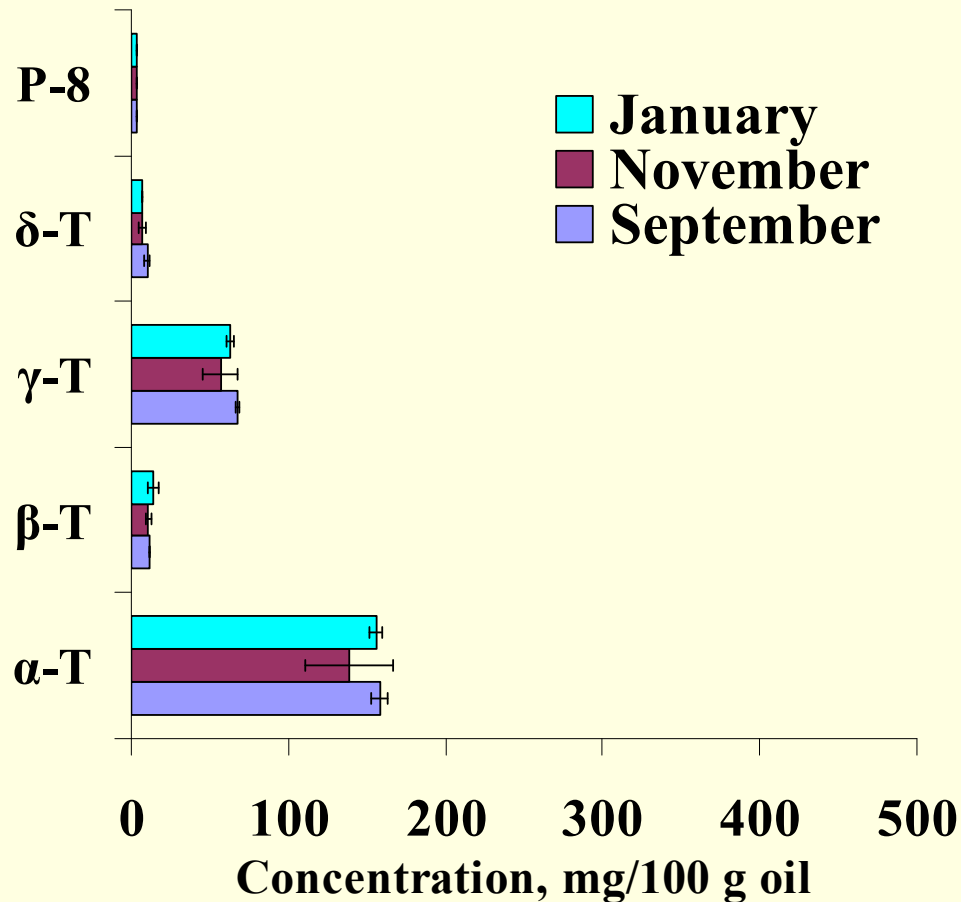
Results – Bioactive testing (tocols in fruit oil)



Harvest time does have a significant effect on levels of α -tocopherol in fruit oil ($p < 0.05$).

Note:
T – tocopherol
T3 - tocotrienol

Results – Bioactive testing (tocols in seed oil)



Harvest time does not have a significant effect on levels of any tocols in seed oil ($p > 0.05$).

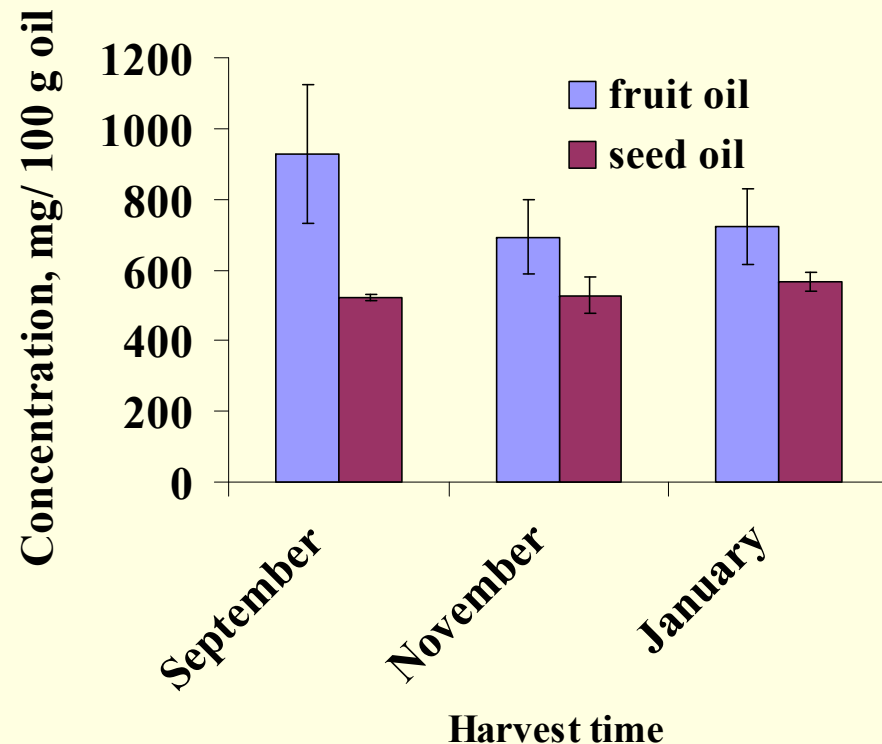
Note:

T – tocopherol

P - Plastochromanol

Results – Bioactive testing (β -sitosterol in fruit and seed oils)

Significant difference in β -sitosterol concentration between (September) and (November and January) ($p < 0.05$).



Discussion – Other Research

Berry development and oil stability

- Most parameters in agreement with European and Asian research performed on *sinensis* berries with regards to ripening effects (i.e. Sept. to Nov.).
- Discrepancies (i.e. higher concentrations of β -sitosterol in fruit fraction) may be due to differences in methodology and sample preparation.
- No comparable research available on winter harvest effects, due to unique climate in Canadian Prairies.

Discussion – Oil stability

Seeds

- Fully developed by September
- Retained stability

Fruit

- Highest levels of α -tocopherol and β -sitosterol and lowest levels of β -carotene in September.
- Highest levels of β -carotene and redness a^* in November.
- Lightness, L^* , only parameter that was highest in January.
- Fatty acid profile remained relatively stable.

Conclusions

Provided key knowledge regarding berry quality and winter harvest.

- Lower quality product with winter harvest.
- Highest quality may be achieved between early maturity (September) and maturity (November), depends on many factors.
- Ripe berries are most difficult to harvest, with presently accepted methods.
- Trade off in quality for ease of harvest.

Acknowledgements

- Manitoba Hydro, Winnipeg, MB
- National Science and Engineering Research Council
- Branching Out Orchards, St. Claude, MB
- Dept. of Human Nutritional Sciences,
University of Manitoba, Winnipeg, MB
- Food Development Centre, Portage la Prairie, MB