Program: Reducing Dietary Phosphorus in Dairy Rations

J. W. Fisher
B.W. McBride
N.E. Odongo
E. Kebreab
D. McKnight
P. Sharpe
A. KoekKoek
J. France

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

In Partnership With

Ontario's animal feed industry

Program Studies:

1. Long-term effects of feeding diet without mineral phosphorus supplementation on the performance and phosphorus excretion in high yielding dairy cows
   - N.E. Odongo (corresponding author)

2. Economic Implications of Reducing Dietary Phosphorus in Dairy Rations

Phosphorus is a mineral fed to dairy cattle to facilitate good health. Recently, the animal feed industry has come to suspect that phosphorus is being fed at up to 30% too much in the diet. Excess dietary phosphorus is excreted by cows and can find its way into surface water causing pollution in our rivers.

Fifty-two cows and heifers at calving were tested at Kemptville Campus, half at a high P level (control; 0.42% P) and half at low P level (0.32% P). The results suggest that the current forages grown in Ontario might contain adequate amounts of P to sustain milk production in mature high-yielding dairy cows without affecting animal performance. However, for growing lactating heifers some mineral P supplementation is recommended especially during early lactation for new bone growth and milk production.

The second study focused on the financial effects of reduced dietary P levels in dairy ration. Nineteen Ontario dairy farms were included in the survey. A 29 per cow per year was found as a result of dietary P reduction from 0.503% to 0.359% P (DM basis). Given conditions in Ontario Canada, a $84 per hectare per year was calculated by a computer model.
When soil P is in surplus an additional $84 per hectare (range $0 – 84.00) per year in benefits is imputed as an intangible environmental benefit. However, when soil P is not in surplus, no environmental benefit is imputed because the system is not reducing the amount of P entering the environment.

Support Appreciated from:

Ontario
Ministry of Agriculture, Food and Rural Affairs

Community benefits include: lower cost of production for farmers, safer ground-water, cleaner rivers and lakes …..

Robotic Milking Systems for Dairy Cows in Ontario: Economics, Milk Quality, Nutritional Enticers

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

J.W. Fisher, J. Rodenburg
D.R. McKnight

In Partnership With

Robotic Milking Industry

The project objectives are:

1. To compare AMS with conventional parlour milking for costs and production efficiency.
2. To monitor raw milk quality and to locate the sources of deterioration if it exists.
3. To evaluate nutritional incentives for effectiveness at enticing cows the robot.
4. To inform dairy producers of economic, quality, and enticer benchmarks for robotic milking.

Methodology:
-"twinned" robots with comparable parlours
-visited farms in winter and summer 2003 to photograph, observe farm activities, collect milk and water samples
-surveyed farmers and manufacturers on installation, repair and maintenance costs of new robots and new parlours
-surveyed farmers on volume of milk produced, SCC and bactoscan data, then analyzed data with SAS system
-22 of 23 farms in Ontario who have robotic milking systems agreed to participate in the study

Support Appreciated from:

Milk DAIRY FARMERS OF ONTARIO

Ontario Ministry of Agriculture, Food and Rural Affairs

Results:
•robots work well in Ontario
•parlour milking time is 3.28 min/cow, compared with 1.02 min/cow for robots
•milk yields were not larger for robots than for parlours
•all water samples were potable on all farms
•it is possible to positively influence robot attendance with nutritional enticer
•Robotic milking is more expensive than with an equivalent parlour
•Robots will save on labour and provide a 'lifestyle change,' which will be seen as good value for the money by some, but not by others
•Robotic milking can increase milk quality levels of bacteria and freezing point unless extra attention is paid to environmental hygiene, but there was more variability within milking systems than between milking systems

Community benefits include: reduced cost of production, better quality of working conditions, improved environmental quality

Program: Economics of Longevity in Dairy Cattle

J. W. Fisher

In Partnership With

Dairy Farmers of Ontario

Program objectives:

- identify the optimum age for a dairy cow
- practical (optimal) culling rate for a dairy herd
- longevity strategy based on business motives
- measure the value of this strategy

Average NPV of worst ranked cows	$4,596
Average NPV of cows actually culled	$9,687
Average NPV of Heifers	$17,678

NPV is the Net Present Value of future earnings (based on contribution margin)

General Information:
Milk production will peak during a cow's fourth lactation, but farmers often to cull cows earlier. This study used an on-farm survey approach that focused on profit motives per cow, and thus has succeeded in predicting what farmers are doing and provides economic reasons why.

Cows are at maximum value during their fourth lactation, thus it is best to keep cows until the fourth lactation. However, Only 22% of culls are optimal, and thus, 78% of culls are involuntary. Most of the culled cows are in their first lactation. NPV of future CM for each involuntary cull is on average $5,091 and the worst ranked cows only have $4,596. Culling the right cows can potentially save $495 per cow per year.

Heifers were clearly superior to low ranking cows. The implication is to keep all heifers

Results:
In our case study, minimal culling rate is 55 cows replaced with 42 heifers: culling rate of 6%. Net benefit = $168 /cow/year
Fixed costs for an average heifer was $2,000. Cows generating less than this should be replaced with a heifer. To do this 40% of cows need to be culled. This is just about all the heifers normally generated on a farm during a year.
Net Benefit = $509 /cow/year

Conclusions:

- All heifers should be kept.
- Avoid culling before four lactations and don't favour older cows.
- If we could eliminate involuntary culling, a voluntary culling rate would be about 17%.

Support Appreciated from:

Dairy Farmers of Ontario

Agricultural Adaptation Council

Ontario Ministry of Agriculture, Food and Rural Affairs

Community benefits include: lower cost of cow replacement, a modest $100 saving per cow can result in an annual $4 million in savings

Program: Costs OF A Maedi Visna Flock Certification Program and the Changes in Productivity and Economic Output

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

J. W. Fisher P. I. Menzies

In Partnership With

Ontario Sheep Producers

Program objectives:

- To quantify the costs associated with a maedi visna flock certification program (MVFCP).
- To determine the conditions under which this program will provide net economic benefits for different sectors of the sheep industry

Methodology:

- A static normative model of the MVFCP was designed.
- Phone interviews were conducted in order to collect data and this information was entered into the model.
- The model calculated the costs of participation in the program. Feedback was given to the participants shortly after the phone interview took place. They were sent a schematic of the MVFCP, copies of the Whole Flock and Monitored flock programs pertaining to their individual situation, and a letter explaining the two programs. Participants were invited to contact the researcher if they had any questions or comments.

This served as a beta test for the model.

Support Appreciated from:

Ontario
Ministry of Agriculture, Food and Rural Affairs

Results:

The two benefits of this program have been identified as a savings of 11 pounds of lamb per year per infected ewe, and for breeders, a more significant bonus of improved sales if displaying a certified status.

- Within these parameters, there seems to be a good economic return for breeders in Ontario. These farms need not be large
- The costs of breeding can reach $15.00 per test and remain optimal.
- Only a portion of lambs need to be sold as breeding stock. We used 25% of sales achieving a 10% improvement in price, which is quite modest.
- Breakeven occurred just before or shortly after becoming 'A' Status for all combinations of flock size, ewe, and breeding sale values and bleeding costs.

Commercial producers on the other hand have a conundrum. If they don't have the disease, the will have no benefit to being on the program.

Community benefits include: economic benefits for all sectors of sheep industry, savings at individual farms

Program: The Economics of Transitioning from Conventional to Organic Dairy - Ontario, Canada

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

J. W. Fisher

In Partnership With

Ontario Organic Farmers

Objectives:

- Survey Ontario dairy farmers who have recently transitioned from conventional to organic farming (2002 – 2005).
- To investigate the economic differences between the average conventional dairy farm and transitioning farms during the transition years.
- To investigate the economic differences between years as the survey farms transition from conventional through three years of transition to organic.

This study examined eight of eleven dairy farms known to have recently transitioned to organic in Ontario, Canada, the earliest of which to transition was in 2002. Economic data were collected for the last conventional year, the three transition years and the first organic year. Comparisons were made for specific year differences for each of the five stages between the subject farm and an industry average; and between year differences for each farm data set over the five stages of transition. Data was adjusted to 1998 dollars.

It was observed that our host farms were predisposed to the organic philosophy for many years prior to beginning the transition to organic. These farms had lower yields, lower revenues, lower costs, and lower net income during their conventional years than did the industry norm. During the transition phase, economic parameters became worse; for example net income was reduced by $251 (1998$) between the transitioning farm's first organic year and their last conventional year. Although these farms had some reduction in economic prosperity during the transition, they remained economically viable.

Fertilizer, chemicals, health costs, purchased feed costs, and marketing costs were all reduced on a per cow basis, while only fuel and fixed costs went up. The largest impact was a 9.8% reduction in milk yield for our host farms between their first organic year and their last conventional year. Importantly, these farms began their transition 11% below the industry norm for milk yield and by the time they were organic, they were 35% below the industry norm. The premiums received during the first organic year plus the reductions in costs were not great enough to offset the decrease in milk yields by the first organic year. It seems optimistic to expect organic farms to compete economically with conventional farming.

Support Appreciated from:

Ontario
Ministry of Agriculture, Food and Rural Affairs

Community benefits include: development and improvement in the organic industry

Program: Assessment of Stallion Sperm Viability by Flow Cytometry and Light Microscope Analysis

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

K Merkies, T Chenier, C Plante, M M Buhr

In Partnership With

Equine Research Centre, Inc.

Objectives:

- Improve reproductive efficiency in horses
- Develop quick and reliable methods needed to assess quality of ejaculate for diagnostic or insemination purposes

Materials and Methods:

- semen extended with EZ Mixin
- fresh sperm (9 ejaculates, 4 stallions) diluted with freeze-killed sperm in ratios varying 0-100%
- cryopreserved sperm (17 ejaculates, 6 stallions) in glycine extender

The viability determined by:

1) total motility (FM)
2) eosin-nigrosin staining (EN)
3) dual fluorescent staining (Fertilight)
   i) flow cytometry (FC)
   ii) microscopy (FM)

Observation:

There is good linear correlation of actual live:dead ratio to the estimated value. Correlation among methods ranged from 0.75 - 0.90 for fresh viability and the correlations among FM, MOT, EN ranged from 0.68 - 0.89, but were lower with FC (0.43 - 0.68) for cryopreserved viability

Advantages of dual staining for viability assessment:

- rapid, simple staining procedure
- easy to differentiate between living and dead sperm
- visual assessment not operator dependent
- staining time and temperature do not need to be strictly controlled

Conclusions:

All methods give comparable estimates of viability, particularly for fresh sperm. However, dual staining evaluated by microscopy gives more reliable estimate of viability than dual staining by flow cytometry.

Support Appreciated from:

EP Taylor trust fund

Ontario Ministry of Agriculture, Food and Rural Affairs

Community benefits include: more efficient reproductive in horses and reliable method to assess the quality of horse reproductively

Program: Heparin-binding Proteins from Porcine Seminal Plasma Influence Heparin-mediated Calcium Uptake Differently in Epididymal and Ejaculated boar Spermatozoa

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

K Merkies, M M Buhr, E Topfer-Petersen, J Calvete, D Wey

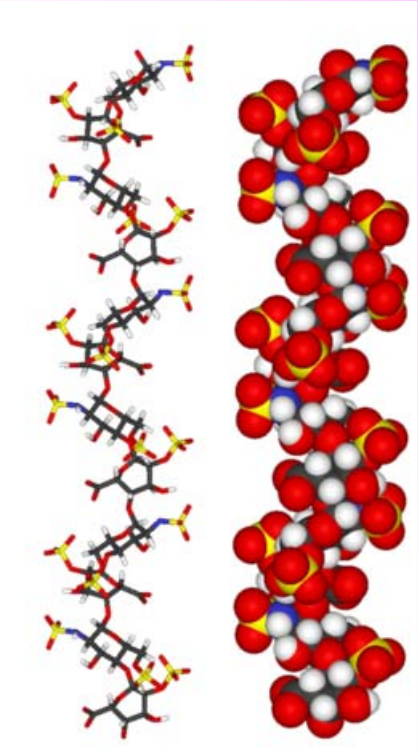
In Partnership With ...

Objectives:

- Assess [Ca++]i in boar sperm
- Compare Ca++ regulation in epididymal and ejaculated sperm
- Determine the effect of heparin (HEP) and heparin-binding proteins (HBP) on Ca++ regulation

Methodology:

HBP from seminal plasma was separated from non-HBP by affinity chromatography using one elution of NaCl.The proteins were identified by SDS-PAGE. Then the ejaculated sperm were collected. We retrieved the epididymal sperm from caput and cauda epididymides. The sperm was incubated in capacitating Ca++-free tris buffer.



Observations:

The response to exogenous Ca++ in absence of heparin:

a) The rate of Ca++ uptake:

- CON: ejaculate>cauda=caput
- HBP: ejaculate>caput>cauda

b) [Ca++]i 50 sec after addition:

- CON: ejaculate=cauda=caput
- HBP: ejaculate=cauda=caput

Summary and Conclusion:

The stage of maturity in boar sperm affects:

1) initial [Ca++]i
2) rate of Ca++ uptake
3) [Ca++]i in presence of HBP
4) response to HEP+HBP

All sperm internalize Ca++.
Rate of uptake are influenced by stage of maturity and HBP.
The effect of HEP is modulated by HBP.

Support Appreciated from:

Government of Canada

Ontario
Ministry of Agriculture, Food and Rural Affairs

Community benefits include: benefits from heparin and more efficient reproductive in horses

Program: Calcium Regulation in Equine Sperm Maturation

K Merkies, M M Buhr, E Topfer-Petersen, J Calvete

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

In Partnership With

Equine Research Centre, Inc.

Objectives:

- role of heparin and glucose in sperm calcium regulation
- effect of sperm maturity on calcium regulation in response to heparin-binding seminal plasma proteins (eAWN)

Observations:

Female Factors:

- all sperm internalized Ca++
- rate of Ca++ uptake (16-30 secs):
  ejaculate = cauda > caput
- [Ca++]i at 60 secs:
  ejaculate = cauda > caput

Effect of heparin & glucose

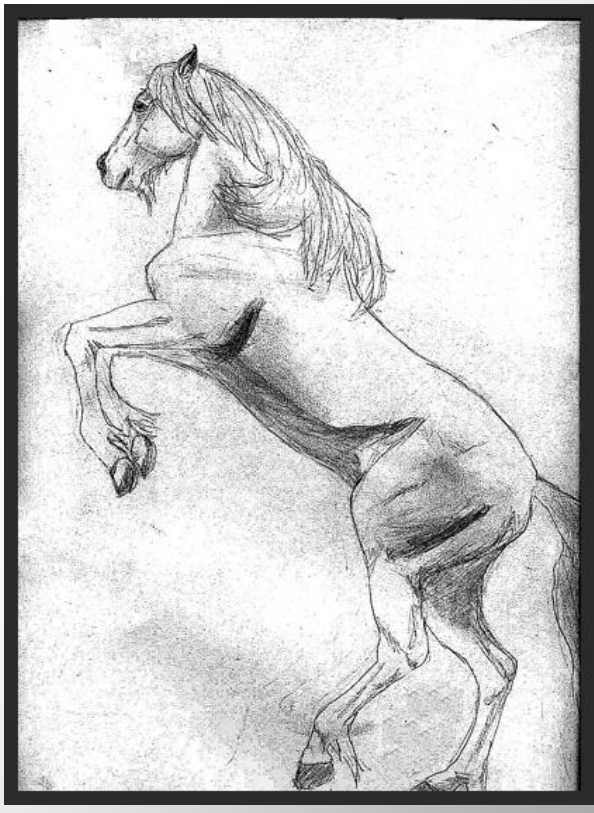
- no immediate effect of HEP or GLUC on [Ca++]i
- HEP increased [Ca++]i in ejaculate sperm from 2 - 4 hours
- at > 30 min, caput = cauda regardless of HEP or GLUC

male factors:

- eAWN from seminal plasma by affinity chromatography & SDS-PAGE
- 5 stallions, 3 ejaculates + epididymal sperm
- [Ca++]i monitored by Indo for 90 min
- eAWN (1mg/ml) added just before t=0
- Ca++ added at 30 min, HEP added at 40 min

Effect of eAWN:

- rate of Ca++ uptake differed among stages and was decreased by eAWN :
  epididymal sperm + eAWN < control
  jaculate sperm + eAWN = control



Summary:

stage of maturity of equine sperm affects:

1) initial [Ca++]i
2) rate of Ca++ uptake
3) response to heparin
4) response to eAWN

Support Appreciated from:

Government of Canada

Ontario
Ministry of Agriculture, Food and Rural Affairs

Community benefits include: benefits from the use of heparin and more efficient reproductive in horses

Program: AAFC-ETAA Project

Assessment of the Production and Land Application of Anaerobically Digested Manure from Medium Sized Livestock Farms

A. Crolla,
R. Desjardins
K. Kennedy
E. Pattey,
B. Ball-Coelho
T. Sahota

In Partnership With ...

Objectives:

1. Evaluate environmental and economic benefits of AD systems for medium sized livestock farms.

2. Evaluate enhanced biogas production through the addition of high organic agricultural and non-agricultural feedstocks.

3. Assess the fate of nutrients, GHGs and pathogens from the storage and land application of digested versus undigested manure, and subsequent environmental and agronomic impacts.

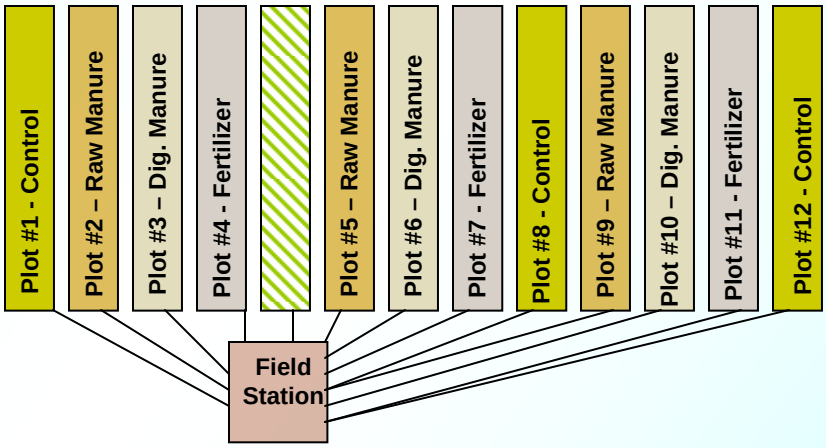
Methodology:

Digesters were evaluated from various locations with a total of 460 cows. Monitoring Parameters include: Ttemperature, pH, biogas production, CH4, VS, COD, VFAs

Land applications were conducted at:

- Alfred: monitoring of soil and water after land application of raw manure, digested manure and inorganic fertilizer.
- AAFC at Ottawa monitoring of soil and air after land application of raw manure, digested manure and inorganic fertilizer.
- Thunder Bay Research Station: monitoring of soil and water after land application of raw manure, digested manure and inorganic fertilizer.

Monitoring Parameters for Water & Soil are NH4+, NO3-, TP, *E.coli*, *Salmonella*, *Enterococci*, and C.*perfringens* and for air: NH3, CO2, N2O, CH4.



Support Appreciated from:

Government of Canada

Ontario Ministry of Agriculture, Food and Rural Affairs

Community benefits include: better environment, better use of biogas

Program: Drinking and defecating frequencies and locations are affected by the presence of water trough when cattle graze over a creek

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

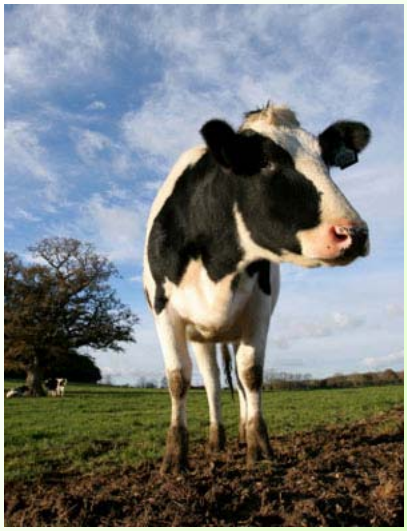
P. H. Sharpe
J. Pitty Del Cid
D. R. McKnight
A. Unc
R. Marcelissen
M. Goss

In Partnership With

Rideau Valley Conservation Authority

Objective:

The objective of this study was to determine the effect of a water trough in the paddock on the frequency and locations of drinking and defecation.



Background:

There have been few studies documenting the effects of cattle defecation on surface water quality in Canadian farming conditions. Thus there is a gap in understanding how provision of an alternate water source affects drinking and defecating behaviour in pastured cattle.

Materials and Methods

Approximately fifteen pregnant Holstein heifers.
Rotationally grazed on a five acre pasture next to a creek in Kemptville, Ontario.

Two treatments :T = Trough in Paddock
NT= No Trough in Paddock

During the T treatment, heifers had a choice of drinking location but during NT they could only drink from the creek.
Heifers were observed 12 hrs/day, 4 days/week, for 4 consecutive weeks in each treatment.
Incidents of drinking and defecating (per zone: pasture, riparian, creek) were recorded.

Summary

The presence of a water trough in the paddock. Increased the frequency of drinking incidents away from the creek. Decreased the number of defecations in or near the creek.

Implications

This study adds to the body of evidence that providing a water trough for pastured cattle may reduce the need for fencing cattle away from surface water.

Support Appreciated from:

Ontario
Ministry of Agriculture, Food and Rural Affairs

Community benefits include: better environment and reduced cost of fencing

Program: Impact of cattle grazing management on microbial indicators of fecal pollution

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

P.H. Sharpe, A. Unc,
J. P. Del Cid, M. Goss,
A. Straathof, R. Marcelissen

In Partnership With

Rideau Valley Conservation Authority

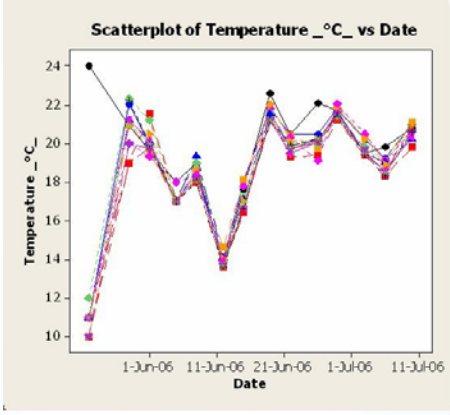
Objective:

The objective of this study was to determine the effect of a water trough in the paddock on the frequency and locations of drinking and defecation.

Measured Parameters in the study:

Sampled water:
1) pH
2) Electrical conductivity (µS cm-1)
3) Water Temperature (ºC)
4) TSS (ppm)
5) Redox potential (mV)
6) Depth of water
7) Flow (m3 min-1)

Environmental parameters:
Air temperature, precipitation, solar radiation



Conclusion:

Major increases in concentrations are associated with rains and thus likely runoff events.

Concentration changes during dry periods (or low intensity rains) are associated with changes in the water chemistry likely driven by temperature kinetics.

Thus both input from grazing animals and changes in microbial numbers driven by changes in the properties of the creek water environment affect the numbers [may increase] of microbial contaminant indicators.

C.perfringens seems to be mostly dependent on environmental parameters

Support Appreciated from:

Ontario
Ministry of Agriculture, Food and Rural Affairs

Community benefits include: improve livestock management, less surface water pollution

Program: INVISTA Bio-solids on Grass Hay 2005

W. E. Curnoe, D. C. Irving, & W. R. Hossie

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

In Partnership With

INVISTA™

Objective:

To determine the effects of different rates of INVISTA bio-solid applied in the fall and spring on the growth and development of a grass crop.

Procedure

At the request of INVISTA (formally Dupont Canada), University of Guelph / Kemptville Campus proposed a field test to evaluate INVISTATM bio-solid application rates. Representatives from INVISTA and Kemptville College agreed to continue the field test in an effort to expand the database of information.

The testing program was field based with a test plot being established on Mr. Andy DeJong's farm. The research was carried out under the direction of W.E. Curnoe, and D. C. Irving, Soil and Environmental Technician, assisted by W. R. Hossie, had the responsibility for the day-to-day supervision of the field program, data collection and report publishing. The INVISTATM bio-solid was supplied by INVISTA.

CONCLUSIONS:

- After three years data, the application of 8 dry t/ha of INVISTA bio-solid, regardless of the time of application produced a superior yield to the recommended application of commercial nitrogen for a grass crop.
- No treatment in this test from 2002 to 2005 elevated soil N-NO3 levels to values that are of environmental concern.
- Over a three-year period, 2002 to 2005, there is no evidence that the soil parameters pH, P, K, Mg, O.M., Na and Ca changed.
- The application of 8 dry t/ha of INVISTATM bio-solids over three years has a minimal effect on regulated metal levels in the soil. The levels measured in the soil are minimal compared to the soil maximum allowable limits.

Support Appreciated from:

Ontario
Ministry of Agriculture, Food and Rural Affairs

Community benefits include: more efficient use of INVISTA bio-solids on grass

Program: INVISTA Bio-solids on Corn 2003 - 2005

W. E. Curnoe, D. C. Irving, & W. R. Hossie

In Partnership With

Objective:

The objective of the test was to determine the effects of different rates of INVISTA bio-solid applied in the fall and spring on the development and growth of a corn crop.

Procedure

The testing program was field based with a test plot being established on Mr. Andy DeJong's farm. The research was carried out under the direction of W.E. Curnoe, and D. C. Irving, Soil and Environmental Technician, assisted by W. R. Hossie, had the responsibility for the day-to-day supervision of the field program, data collection and report publishing. The INVISTA bio-solid was supplied by INVISTA.

The application of INVISTA bio-solid and commercial fertilizer and planting was undertaken by University of Guelph/Kemptville Campus. Herbicide application was carried out by Third High Farms.

CONCLUSIONS

1. After three years of reliable data, applications of InvistaTM biosolids at 4 dry t/ha. in the fall plus 12 dry t/ha. in the spring (treatment 7) or at 8 dry t/ha. in the spring (treatment 3), will produce statistically superior corn crop yields to an application of 150 kg/ha of nitrogen from commercial fertilizer.

2. After three years (2003, 2004 and 2005) of yield data every treatment containing INVISTATM biosolids will produce yields statistically equivalent to the standard recommended level of 150 Kg/ha of nitrogen from commercial fertilizer.

3. After three years of application of INVISTATM biosolid at the rate of 16 dry t/ha, a measurement of the regulated metals in the soil shows that all metals are low and well below the maximum allowable levels.

4. After four years of application of INVISTATM biosolids, the only soil parameter that shows any substantial elevation was Mg., however it is still well within

Support Appreciated from:

Ontario Ministry of Agriculture, Food and Rural Affairs

Community benefits include: more efficient use of INVISTA bio-solids on corn

Program: Domtar Soil Conditioner (Cornwall) on Field Corn 2003 - 2006
— Phosphorous and Organic Matter Monitoring

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

W. E. Curnoe, D. C. Irving, & W. R. Hossie

In Partnership With

Domtar

Objective:
The objective of this test was to monitor phosphorous and organic matter levels with successive applications of DCSC.

Background:
There currently exists some concern that applications of Domtar (Cornwall) Soil Conditioner (DCSC) year after year could tend to elevate soil phosphorous levels. There is also a suggestion that the use of DCSC every year as an alternative to commercial fertilizer will slowly and steadily elevate the soil organic matter levels resulting in increased soil fertility.
The program was field based with the experiment being conducted at the Winchester Research Station with successive applications of DCSC on field corn over a 4 year period.

Conclusions (Years 1, 2 and 3)
After three years of DCSC application:

1. Soil P levels remain at the same level. There is no indication of elevated soil P levels with successive applications of DCSC.

2. Soil organic matter levels are decreasing slightly each year. Although statistically the same treatment 3 (10 t/ha. of DCSC in the fall and 15 t/ha. in the spring) had the highest soil O.M. levels in all years when compared to the other two treatments with commercial fertilizer.

3. Soil Na levels are lower and soil Ca levels slightly higher. These levels do not merit the calculation of a sodium absorption ratio (S.A.R).

4. Corn yields for all treatments are deemed equivalent because they are all in the same yield group.

5. Soil N-NO3 levels are low at 5 - 7 ppm at soil depths (0-15 cm, 15-30 cm and 30-45 cm.). To be environmentally responsible the fall soil N-NO3 level should be less than 30 ppm at the 0-15 cm.

Support Appreciated from:

Ontario Ministry of Agriculture, Food and Rural Affairs

Community benefits include: more efficient use of BCSC on corn fields

Program: Domtar Soil Conditioner on Forages 2003 - 2005

W. E. Curnoe, D. C. Irving, & W. R. Hossie

In Partnership With

Objective:

➢ To determine forage crop yield following the application of soil conditioner from Domtar Cornwall (DCSC) and Domtar Ottawa/Hull (DCHSC), a multi-year trial (2003-2006) on alfalfa and a grass crop was selected.

➢To measure the effect of two applications per year (spring and after 1st cut) of DCSC and DOHSC on the yield of an alfalfa and a grass crop.

Background:

This study was initiated by Domtar Inc., Cornwall Mill, as part of its ongoing Agronomic Research to support the land application of Domtar Soil Conditioner.

The research was conducted under the direction of W. E. Curnoe. D.C. Irving and assistant W. R. Hossie had the responsibility for the daily supervision of the field program, data collection and report publishing. Domtar was responsible for making the DCSC and DOHSC available and soil analysis and plant tissue analysis was determined independently by Accutest Laboratories of Nepean, Ontario.

CONCLUSIONS (2003 - 2005)

- Soil N-NO3 levels at the alfalfa and grass sites remain low after three years of application of DCSC and DOHSC.
- DCSC has increased P levels after three years of bio-solids application on the low testing site. However, the K levels have fallen on the same site indicating supplemental commercial fertilizer may be required in addition to the bio-solid application for the long term.
- The application of DCSC at 12.5 t/ha in the spring and 12.5 t/ha after the 1st cut and the application of DOHSC at the same rate on alfalfa produce a similar crop yield to recommended commercial fertilizer rates.
- DCSC is able to produce a grass crop with higher nitrogen content than either commercial fertilizer or DOHSC.

Support Appreciated from:

Ontario Ministry of Agriculture, Food and Rural Affairs

Community benefits include: more efficient use of DCSC on hay fields

Program: Casco Bio-solids Spring Application on Corn 2006

W. E. Curnoe, D. C. Irving, & W. R. Hossie

In Partnership With

Objective:
The objective is to determine the effects of spring applied bio-solids produced by Casco, on corn crop development and yield. The levels of soil N-NO3 as a result of spring application were also monitored.

Background:

The program was field based with an experiment being conducted on Third High Farms, under the direction of W. E. Curnoe, Researcher and former Director at University of Guelph / Kemptville Campus. D. C. Irving, Soil and Environmental Technician, had the responsibility for the day to day supervision of the field program, data collection and report publishing, assisted by W. R. Hossie.

The test was designed and staked out by Kemptville Campus on Third High Farms (Robertson Farm, Lot 9, Conc. 1 of South Dundas Township in Dundas County). The product was transported from the Casco, Cardinal site and applied by Third High Farms. The contact at Casco was Gerry Morand, Process Engineer.

CONCLUSIONS:

- Treatments 4 & 5 (180 m3/ha & 240 m3/ha of Casco bio-solids) produced a better yield than that of the recommended amount of commercial nitrogen.
- The application of Casco bio-solids generally increases soil organic and promotes higher water holding capacity, better soil aeration and improved soil tilth as well as increased fertility.
- All measured soil parameters, other than N-NO3, are higher at the conclusion of the test in 2006 than they were in the spring of 2003.
- After four years of continuous annual application of Casco biosolids, none of the 3 application rates used in this test elevated soil N-NO3 levels to areas of environmental concern.

Support Appreciated from:

Ontario Ministry of Agriculture, Food and Rural Affairs

Community benefits include: more efficient use of Casco bio-solids on corn fields

Program: Performance of Cattle on Pearl Millet in Canada

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

P.H. Sharpe, D. R. McKnight, P. Barr, & N. Gurung

Support Appreciated from:

Ontario
Ministry of Agriculture, Food and Rural Affairs

OBJECTIVES

- ❖Determine performance of cattle on a new variety of PM silage, relative to a control mixture of alfalfa, grass and corn silages
- ❖Measure growth rate in Holstein steers (n=20) and beef heifers (n=24) when increasing percentages of control silage were replaced with PM silage (1996)
- ❖Measure growth rate in replacement beef heifers (n=20) (1997)
- ❖Measure milk production and quality in Holstein cows (n=8) (1997)

	1996	*1997*
Method	Control diet was corn-alfalfa-grass silage. Treated calves ate: 20% pearl millet on days 1 - 21 40% pearl millet on days 22 -42 60% pearl millet on days 43 -62 80% pearl millet on days 63 -77	Beef :Control vs. PM silage for 111 days. Two pens of 5 heifers per treatment; weigh every 14 days Dairy: Control or PM silage for a period of 4 weeks; 4 cows/diet Switchback design with 4 periods
Result	Heifers and steers on PM were significantly heavier day 0 - day 42 (20% and 40% PM) At day 63 (60% PM), body weights were the same. At day 77 (80% p.m.), treated calves weighed less than controls (P<0.05)	DM intake 22.1 ± kg control and 23.8 ± kg PM (P>0.05) Body weights increased 30 kg periods 1-3; no effect of diet. Milk production 33.2 ± kg control and 31.5 ± kg/cow/day PM (P>0.05) Milk fat was about 1.21 Kg/cow/day (no diet effect)

CONCLUSIONS

- ➢ PM provided adequate nutrients for cattle growth when replaced up to 40% of common forages
- ➢ A largely PM silage diet allowed beef heifers to gain nearly 1 kg / day, which was 12% less than gains on control silage
- ➢ DM intake, body weight, BCS, milk protein production, milk fat production or milk production not affected by diet
- ➢ Considering problems with herbicides and weeds and inexperience with the crop, levels of animal performance are encouraging

Community benefits include: more efficient use of pearl millet as feeds

Program: The Total Diet Study

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

Elizabeth K. Forbes

In Partnership With

bureau of chemical safety

Objective:

➢The food composites are analysed for toxic and nutritionally important chemicals, by the Food Research Division in the Bureau of Chemical Safety, and their partners

➢ The measured concentrations are then combined with food intake information to give estimates of the dietary intakes of these chemicals for Canadians

Background:

- Recommended by the World Health Organization (WHO) for accurate estimates of dietary intakes of contaminants.
- Since 1969, Health Canada has conducted Total Diet Studies in five different periods of time to estimate the levels of chemicals to which Canadians in different age-sex groups are exposed through the food supply.
- These studies are organized by the Food Research Division in the Bureau of Chemical Safety
- Supported by partners both within Health Canada (e.g., the Nutrition Research and Evaluation Divisions, the Regional Laboratories of the Health Products and Food Branch, Pest Management Regulatory Agency, and outside of Health Canada such as Canadian Food Inspection Agency, and Kemptville Campus).

Procedures:

➢The food samples are sent to the Kemptville Campus, University of Guelph

➢They are processed as for consumption in the average household kitchen

➢The processed foods are then mixed according to each category to make composites (140)

➢Frozen samples are delivered to the Food Research Division in the Bureau of Chemical Safety, Ottawa

Support Appreciated from:

Health Canada

World Health Organization

Ontario
Ministry of Agriculture, Food and Rural Affairs

Community benefits include: …

Program: Effect of Level of Corn Silage and Growth Rate of Pre-pubertal Heifers on Milk Production and Longevity

P. H. Sharpe, J.J. Morgan, D.R. McKnight, J.P. Del Cid, & B. Dow

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

Objective:

❖To study the effects of pre-pubertal:
Growth rate
Corn silage level
on lifetime performance of dairy cattle

Materials:

❖2 X 2 Factorial
❖2 levels of corn silage (1/3, 2/3), plus haylage, high moisture corn and soybean meal, with equal levels of energy and protein
❖2 rates of gain (700, 1000 grams/day)
❖4 groups of 48 heifers, start at 4 months old, borrowed from 2 local farms

Results:

- Low growth treatment 728 g/day (4% above target of 700)
- High growth treatment 913 g/day (8.7% below target of 1000)
- By 10 months, 35% heifers ovulated
- No treatment effects
- By 12 months: 67% heifers ovulated
- Within Low CS, more in Hi Gain (81%) than in Lo Gain (56%) ($P<0.05$)

Conclusions:

- Heifers can be fed to gain within 8.5% of targeted growth rates.
- Corn silage level had no effect on weight gain or growth measurements (height, girth or teat length).
- The higher feeding rate to promote faster growth was effective on weight, height, girth and teat length.
- The number of days in milk in completed lactations was not affected by treatments.
- There was a tendency for Low Corn Silage and Low Gain Rate to have more cows left after 3 lactations.

Support Appreciated from:

Ontario Ministry of Agriculture, Food and Rural Affairs

Milk Dairy Farmers Of Ontario

Community benefits include: better way to grow heifer, effective use of corn silage and reduce reliability on alfalfa haylage

Program: Dairy Heifer and Cow Longevity

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

P. Sharpe

J. Morgan

D. McKnight

Objective:

1. Determine growth patterns, productivity, fertility and longevity of a group of 192 Holstein females from approximately 4 months of age through their first 3 pregnancies and lactations.
2. Determine whether the proportion of corn silage in heifer growth diets or the rate of heifer growth affects body growth, teat length, age at conception, age at calving, milk production, milk composition, reasons for culling and longevity in Holstein females.

Project Findings:

- Animals fed to gain at the higher rate (about 900 g/day) from four to twelve months of age had significantly greater hip height, hip width, heart girth and teat length at twelve months than heifers fed to gain at 700g/day.

- By about 10 months of age, 35% of all heifers had ovulated, with no effect of corn silage level or rate of gain. By about 12 months of age, 67% of all heifers had ovulated. The only significant treatment effect was that within the heifers fed low corn silage, there was a higher rate of ovulations for the high gain treatment (81%) than within the low gain treatment (56%). Thus there was no negative effect of rapid gain on puberty onset.

- Total milk yield for cows in replicates 1, 2 and 3 so far, indicated no significant effect of corn silage level or gain rate on first lactation milk yield. Least squares mean total milk production regardless of lactation was averaging around 9900 to 10,100 kg according to the November 2005 DHI test and no significant effect of treatment is evident.

- Final conclusions will be made when more cows representing all replicates have completed all three lacations.

Support Appreciated from:

Ontario Ministry of Agriculture, Food and Rural Affairs

Milk Dairy Farmers Of Ontario

Community benefits include: determine the growth pattern of heifers, more efficient way of feeding, maximizing heifers' growth potential

Program: Economic Comparison of Soft Covered Barns Vis-à-vis Post-Frame Steel Clad Barns for Lactating Dairy Cows in Ontario

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

Jim Fisher **Paul Sharpe**

In Partnership With …

Objective:

	Plastic	Canvas	Industry
Number of barns	2	7	
Averagr cows to capacity (range)	100 (50-150)	67 (40-100)	57
Barn size (square foot)	9,480	7,011	
Area per cow	95 (78-144)	105 (64-142)	90
Average winter milk yield	28.2	24.8	24.5
Average summer milk yield	24.2	25.2	24.5

Barns (60' by 120')	Plastic	Canvas	Post Frame
Total purchasing cost	$51,184	$76,042	$102,654
Footing + steel purchase	$46,224	$73,442	
Skin purchase cost	$4,960	$2,600	
Annual depreciate cost	$1,995	$2,969	$3,696
Annual Interest Cost	$22,32	$3,335	$4,517
Ownership cost	$4,227	$6,304	$8,213
Insurance cost	$262	$390	$456
Average Annual Total Cost	$4,489	$6,694	$8,669

Support Appreciated from:

Ontario Ministry of Agriculture, Food and Rural Affairs

Milk Dairy Farmers Of Ontario

Community benefits include: …

Program: Organic Transition Business Planning and Risk Management

Jim Fisher

In Partnership With

Objective:

Project Findings:

Support Appreciated from:

Community benefits include: a tool to assess risk in transitioning, helping to smooth the transition to organic farming

Program: 2006 Chinese Delegation Visit Project

J. Fisher, P. Sharpe, P. Remillard

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

In Partnership With

Government of Canada
Government of China

Introduction
China is undergoing significant change. The demand for food is rapidly growing. As well, food processors are demanding both higher quality and safe food for domestic consumption, and are requiring producers to meet international standards for export markets.

Objective
The objective is to assist China's small farmers to adapt to these new demands, gain new market access, improve rural livelihoods and meet China's obligations as a member of the WTO

Program Description:
In the summer of 2006 Kemptville Campus hosted a group of Chinese delegates here in Canada The group of delegates from the Chinese Ministry of Agriculture came to the campus for two weeks of intensive instruction, mainly concentrating on the role of Canadian producer associations, and their applicability to the Chinese situation.

The Chinese are most cognizant of the fact that success in global agri-business not only hinges on sound production practices, but also on strong marketing and unified approaches to distribution, marketing, and sales. Hence the topics addressed in the training included agriculture policy at national and provincial levels, producer groups and associations – together their structures within the agriculture industry, and lectures concentrating on domestic vs. global marketing.

This program was an excellent learning and cultural experience for both the Chinese delegates and the trainers, and an opportunity to develop enduring "global" friendships!

Support Appreciated from:

Government of Canada

Representatives from the Canadian Federation of Agriculture, the Ontario Federation of Agriculture, the Ontario Cattlemen's Association, Dairy Farmer's of Ontario, the Canadian Farm Business Management Council, Agriculture Canada, the Canadian Pork Council, the Canadian Broiler Hatching Marketing Association, and the Canadian Seed Growers Association were just several of the notable participants involved in the training.

Community benefits include: exchange of cultural experience, international friendship and partnership, potential to improve agricultural situation in China

Program: Agro-forestry Education Centre

J. Fisher P. Remillard
V. Daniels T. Hunter

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

In Partnership With

Objective:

Project Findings:

Support Appreciated from:

Ontario
Ministry of Agriculture, Food and Rural Affairs

GRENVILLE
Community Futures Development Corporation
Building Smart Business
Building Smart Communities

Community benefits include: …

Program: Demonstration and Research on Reverse Osmosis (RO) Technology in a State-of-the Art Maple Production Facility

S. Lachance

T. Chajkowski

M. Sydor

Objective:

To demonstrate the use of the RO unit and collect performance data of the RO unit

To estimate economic and environmental energy savings through fuel, electricity and hourly use measurements;

To continue to monitor the performance of the RO unit for several years.

Project Findings:

The use of Reverse Osmosis technology in the maple industry should be encouraged. There is an enormous amount of environmental benefits, time savings and cost savings of using RO technology.

For a situation where the numbers are similar to Kemptville Campus (1100 taps, RO unit and evaporator adapted to that size), the cost savings for oil would be about $2440 and you will likely increase the grade of the syrup produced. Assuming a salary of $15/hour for maple producers, then the time savings would add up to $3646 in savings. This would result in more than $6000 in savings over the course of one maple season, not considering the beneficial impact on the environment because less pollution (>10 tonnes of CO_2 avoided) is being produced.

Producers must clean and sterilise housing and RO unit, as recommended by the manufacturer. Clear protocols on proper washing of the unit should be provided by the manufacturers. A poorly maintained RO unit can reduce its efficiency and contaminate the sap. Reverse osmosis technology must be accompanied with the application of best management practices throughout the production system. This would include processing sap as quickly as possible and maintaining sap as cool as possible.

Support Appreciated from:

Community benefits include: promotes the use of RO system which induces savings through fuel, electricity and hourly use, reduce environment pollution

Program: Bedding management and low-risk methods for the sustainable control of insect and mite pests and diseases in livestock production

S. Lachance
P. Sharpe
J. Fisher
L. Tikofsky
K. Floate
G. Gibson

Objective:

General objective: Control or repel arthropod parasites and pest insects using biological and low-risk methods that are economically beneficial to farmers, and develop/improve recommendations within a sustainable external parasite control program.

Project Summary:

The organic livestock sector has significant opportunities for incremental growth. An on-farm survey of transitioning dairy farmers in Ontario showed that milk yields for transitioning dairy farms decrease by 9.8% between their last conventional year and their first organic year. Production techniques that will improve organic yields and animal health are desperately required. Also, because of the financial cost, health, food and environmental concerns over the use of pesticides, efforts should be made to identify and develop reduced-risk strategies for external pest management, mostly centered on preventative methods. The project will assess much needed low-risk technologies for the management of insect and mite pests to reduce the risks associated with pesticide use for the animals, humans and the environment. The effect of the methods on animal health will be evaluated, as well as the economic and environmental benefits.

Availability of low-risk pest control materials is very limited in animal production. Several promising materials, technologies and methods will be tested, at various livestock facilities in Ontario and Québec, to manage pest insects in livestock production and reduce the incidence of vector-transmitted diseases, such as pink-eye. It is expected that vector-born diseases transmitted to animals and humans will be on the rise in Canada due to global warming. Research is also planned in biodiversity management and manure management in pasture as ways to promote pest control and economic services to farmers

Support Appreciated from:

Agriculture and Agri-Food Canada / Agriculture et Agroalimentaire Canada

Agricultural Adaptation Council

Ontario Ministry of Agriculture, Food and Rural Affairs

Cornell University

Community benefits include: more effective ways to mange pests, reduced cost of pesticides, reduce danger to environment and human health

Program: Evaluation of the Efficacy of Various Sap Filters in Modern Sugar Bush Operations

S. Lachance, A. Crolla, L. Lagacé

Collège d'Alfred
UNIVERSITÉ de GUELPH

In Partnership With ...

General objective:
To evaluate and quantify the effectiveness of several sap filters at improving the quality of maple sap and thus maple syrup.

Project Summary:

Sap may become contaminated with microorganisms through contact with unclean surfaces. Microorganisms will also build-up in sap as conditions warm-up during the syrup season. This may cause the production of maple syrup of lower quality, darker grade, and less desirable flavour. Sap filters can remove residue or debris, which may inadvertently enter the sap through the collection system or during storage. Moreover, filtering may improve the storage potential of maple sap, improve sap quality during mid- to late-season sap flows and help in keeping the evaporator system clean.

Several sap filters were tested for their efficacy at improving the quality of sap and syrup for the 2005 and 2006 seasons. The diatomaceous earth filter (DE), cylindrical filter with wrapped cloth (cyl./cloth), bag sap filter and a 5 microns polypropylene cartridge filter reduced total particles in sap by 52%, 31%, 23%, and 12%, respectively.

Given the appropriate filter type, filtering the sap can reduce particles, bacteria, yeasts and moulds to a certain extent. This will increase the purity of the sap and protect the reverse osmosis unit, where applicable. As expected, there was also an increase in particle counts and microorganisms as the season advanced. Filtration must always be accompanied with the application of best management practices throughout the production system. Preventative methods to reduce microbial growth, such as maintaining sap as cool as possible and processing as quickly as possible, are encouraged.

Support Appreciated from:

Ontario Ministry of Agriculture, Food and Rural Affairs

Ontario Maple Syrup Producers Association

Agricultural Adaptation Council

Community benefits include: reduced cost of producing maple syrup, better ways to make quality maple syrup

Program: Distance Education Training for the Food Processing Industry in Sub-Saharan Africa

D. G. Mercer, D. B. Lund, J. S. Meech

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

In Partnership With

Sub-Saharan Countries

Objectives:

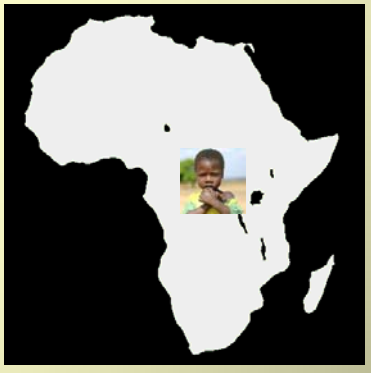
1. To provide educational opportunities through distance education to the food industry in Sub-Saharan Africa
2. To develop a consensus on the content of the distance education training program for the food industry in Sub-Saharan Africa
3. To develop training modules in Food Science and Technology leading to a comprehensive training program
4. To assess the training program through application of a pilot training module

Project Summary:

About 31% of children are malnourished and food availability is a major determinant in reducing child malnutrition. However 5% to 60% (average 25%) food losses usually occur during food processing.

Supply chain management offers opportunities to reduce food losses. Education in supply management is key in enhancing food availability, Reducing food losses by one-half will increase food availability by 15%.

A pilot training module on “Food Dehydration and Drying” has been developed. Implementation is currently being explored in several host nations, and with a major provider of distance education material in this region. Also efforts are currently underway to build a partnership with a distance education institution to deliver this course material. The target for launching the initial pilot course, “An Introduction to Food Dehydration and Drying”, is February 2008.



Support Appreciated from:

The International Union of Food Science and Technology

IUFoST

The South African Association for Food Science and Technology

Community benefits include: providing essential training in Sub-Saharan Africa for a sustainable food supply, project has been identified in the United Nations Millennium Declaration

Program: Prediction of Water Removal Rates During Solar Drying of Food Material by Means of a Laboratory-scale Tray Dryer

D. G. Mercer

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

In Partnership With

Objectives:

1. To assess the ability to replicate solar drying conditions in a laboratory-scale try dryer
2. To investigate the drying kinetics of food materials under various conditions and assess their potential applicability for solar drying
3. To identify possible methods of enhancing solar dryer performance

Project Description:

A prototype solar dryer was designed and built. Its compactness when disassembled, plus ease of reassembly, permitted its use for solar drying trials in Equatorial Guinea (Western Africa) and Honduras (Central America), as well as in Canada.

Data gathered during the solar drying trials were compared with results obtained in tests conducted using a laboratory-scale Armfield tray dryer equipped with volumetric airflow and temperature adjustment capabilities.

Conclusions:

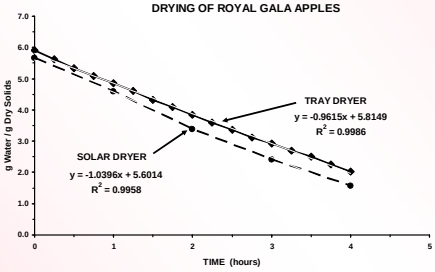
Based on the information presented above, it can be seen that:

The Armfield Tray Dryer is effective in duplicating drying conditions found in the prototype solar dryer during trials with Royal Gala Apples and Roma Tomatoes.

Air velocity has a pronounced effect on the drying of food materials such as Royal Gala Apples. Higher air velocities increase rates of water removal and reduce the length of the constant rate drying period.

Efforts should be made to enhance the rate of airflow through solar dryers in order to improve their overall performance and reduce drying times.

FIGURE 1: COMPARISON OF SOLAR DRYING and TRAY DRYING OF ROYAL GALA APPLES



Support Appreciated from:

Canadian International Development Agency

Community benefits include: improve the efficiencies of the drying process, providing means to preserve perishable crops in some countries

Program: Drying Kinetics of Food Products

UNIVERSITY of GUELPH
KEMPTVILLE CAMPUS

D. G. Mercer

In Partnership With

…

Objectives:

To understand the manner in which food products lose their moisture during drying which is critical to the design and operation of industrial drying processes

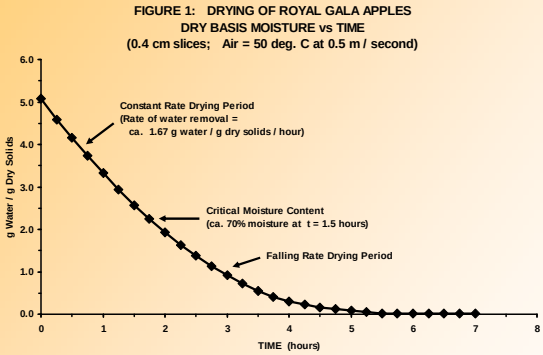
Project Description:

All too often, drying processes are based on the idea that it is only necessary to add as much heat to the product as possible, as rapidly as possible. The final result is often a product with poor functionality, reduced nutrition, altered taste and potentially a toasted colour. In some cases, the product may be case-hardened (i.e. has a hard dry shell on the outside and a moist centre) which can result in undesirable changes in product attributes over time.

Drying test results

A typical drying curve for apple slices is shown in Figure 1. The constant rate and falling rate drying periods are shown. The dry basis moisture at which the transition occurred is approximately 2.3 grams of water per gram of dry solids, which corresponds to a wet basis moisture of 70 %. The rate of water removal during the constant rate drying period in Figure 1 is about 1.67 grams of water per gram of dry solids per hour. This occurred at approximately 1.5 hours into the drying trial.

Air temperature, air velocity, and physical product attributes (e.g., thickness, specific surface area, etc.) can have significant impact on the drying rate, and the time taken for a product to reach its critical moisture content. In Figure 1. apple slices 0,4 cm thick were dried in air at 50°C having a linear velocity of 0.5 m/second.



Support Appreciated from:

Community benefits include: assisting food processors in establishing optimal conditions for drying, improving final product quality with reduced losses