



## Essex Continental Distributors Inc.\*

As Hank Vander Pol looked around the table he could see the concern on the faces of the other Board members. It was a beautiful day in late November 1998, but the mood in the Boardroom of Essex Continental Distributors Inc. (ECDI) was somber. The main topic at the meeting was the voluntary receivership of Essex Continental's largest wholesale customer, Botner Wholesale Ltd. Botner operated on the Montreal Food terminal selling a wide range of produce to customers from their terminal location. While the company had been a bit slow paying its bills, the move into receivership caught the ECDI directors by surprise. ECDI stood to lose \$250,000 in receivables but, more important, it had just lost its only access to the wholesale food terminal and over \$1M in sales annually.

Botner's restructuring was quick. Under a court-approved plan creditors were to receive \$0.60/dollar spread over five years, with no interest penalty. Botner planned to be back in business within a few weeks. ECDI management doubted that Botner would be able to recover and thought that the repayment plan was unrealistic. In Hank's opinion, they would be lucky if they received six cents on the dollar. The directors needed to frame ECDI's response to the situation quickly before the company's share of the wholesale specialty produce market was taken by competitors.

While the issue was important, Hank was distracted by broader concerns about the fit between ECDI and his core business and how any changes might affect that fit. As President of Rol-Land Farms Ltd., a large mushroom producer in Blenheim Ontario, Hank's major concern was protecting and promoting Rol-Land interests. Rol-Land owned 29% of ECDI and supplied the distributor with approximately \$4,000,000 in mushrooms and \$200,000 in other produce annually. Hank wasn't convinced that the entire mushroom supply chain, from Rol-Land through to ECDI and its customers, was running as efficiently as possible. Rol-Land had undergone a major change in the last eighteen months, acquiring a production facility that tripled its mushroom production capacity. The impact of the purchase, financially

\* This case was prepared by David Sparling, Erna van Duren and Lynn Vander Pol of the Dept. of Agricultural Economics and Business, University of Guelph. It is intended as a basis for classroom discussion and does not represent either correct or incorrect handling of administrative problems. Some of the data in the case has been disguised to protect confidentiality.

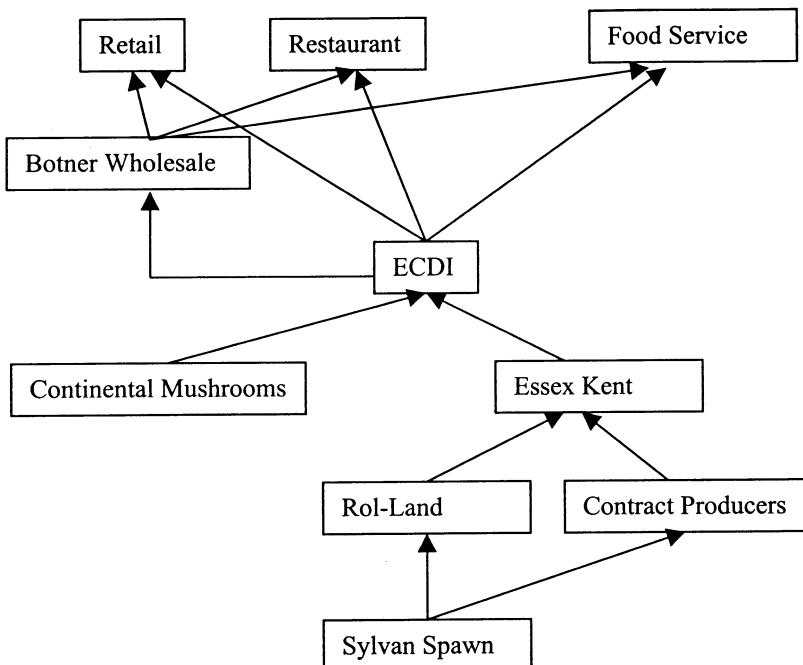


Exhibit 1. Organization of the Rol-Land to ECDI Mushroom Supply Chain

and operationally, was still being felt at Rol-Land. To further complicate matters Hank was investigating options to expand horizontally or vertically. Each had its own risks and rewards, but the company was not in a position to undertake all of them. Hank knew that he had some serious decisions to make and ECDI's response to Botner was just one of them.

## 1. The organizations involved

The supply chain leading to Botner and ECDI's other customers involved several different organizations shown in Exhibit 1. Hank Vander Pol is closely connected with Rol-Land Farms, Essex Kent Distributors and ECDI. The relationships between these organizations have undergone a number of changes in recent years.

### 1.1. *Rol-Land Farms production*

Rol-Land Farms Ltd. began in 1971 as a dairy and cash crop operation when the three Vander Pol brothers took over their father's farm. Hank left a partially completed PhD program at the University of Toronto and a teaching position at the University of Guelph. Previously, he held positions at Ford Motor Company of Canada, which he joined after completing an undergraduate Agricultural Business degree at the University of Guelph and an MBA at the University of Toronto. Pete and Art had worked for their father all their lives,

## Exhibit 2

## Rol-Land Farms Revenue by business line

Business Line	Projected 1998 Revenue
Mushrooms	\$12,000,000
Specialty crops	\$2,000,000
Seedling plants	\$900,000
Warehouse rental	\$250,000
Produce marketing	\$200,000

starting full-time employment after completing high school. Hank has held the position of president since the Rol-Land's creation.

In 1979, sensing the limited upside potential for cash crop operations, the brothers decided to enter the mushroom business. They constructed a \$2 M facility on 12 acres of land in Blenheim and Rol-Land changed from a specialty cash crop operation to a mushroom business employing 90. The company added distribution and trucking divisions as it grew through the 1980s.

Rol-Land purchased Kingsville Mushroom Farms Ltd. in 1997, a mushroom production company located in Kingsville, about 85 km from Blenheim. This second facility added 6.5 M pounds of annual mushroom production capacity to Rol-Land's existing capacity of 3.5 M pounds. In 1998 Rol-Land had five main business lines and employed 250 people. Projected 1998 revenue by primary business line is shown in Exhibit 2. A summary of Rol-Land's balance sheet is found in Exhibit 3.

### 1.2. Essex Kent Mushrooms-Ontario distribution

In 1981, Rol-Land joined in an equal partnership with two Ontario mushroom companies, Kingsville Mushroom Farms Inc. and Highline Produce Ltd. to create Essex Kent Mushrooms. Essex Kent was intended to distribute partner mushrooms and specialty produce throughout the Ontario market. When Highline left Essex Kent in 1991 a new company replaced the partnership, Essex Kent Mushrooms Inc., owned equally by Rol-Land and Kingsville.

## Exhibit 3

## Rol-Land Farms Ltd.

Balance Sheet December 1997		
Current Assets	Current Liabilities	
	3,500,000	1,500,000
Capital Assets	Long term liabilities	
Equipment		10,500,000
Buildings		
Land		
	Shareholder Equity	
		10,000,000
		\$22,000,000

### *1.3. Essex Continental Distributors Inc.-Quebec distribution*

Essex Continental Distributors Inc. was a distribution and marketing company located in Montreal. The company sold specialty produce into the Montreal and Quebec City markets, serving retail, wholesale and restaurant customers. Essex Continental was established as a joint venture between Continental Mushroom Farm Inc. of Metcalfe in eastern Ontario and Essex Kent Mushrooms Ltd. of Kingsville, in southern Ontario. Both firms had been shipping into the Quebec market during the late 1980s working through third party distributors. In 1989 Essex Kent's only Quebec distributor closed leaving the Essex Kent without Quebec representation. Continental was dissatisfied with the distributor they were dealing with. When the largest mushroom producer in Quebec went out of business in 1989, Ontario mushroom production of 45M pounds/year far exceeded the remaining Quebec production of 5M pounds/year. The management of both Essex Kent and Continental recognized the opportunity presented by the void in the Quebec market but both felt that they needed more control over distribution in the province in order to capitalize on it. To achieve this control, a new entity, ECDI, was created with the two principals, Continental and Essex Kent owning 40% each. The principle objective for ECDI was to sell produce grown by the two partner companies into the Quebec market. The remaining 20% ownership was split between the two distribution managers running the company. Frank Ferrarrelli was named President and is in that position today. The other manager stayed with the company until 1994 when he was terminated and his shares were repurchased. Those shares were not redistributed.

When Highline split from Essex Kent, Highline retained its 15% ownership of ECDI but was a silent partner, neither selling to ECDI nor taking part in decision making. In 1996, Highline established its own Quebec distribution company, Agrisol. This left two major ECDI shareholders which were both family owned and operated, Continental Mushroom Farm Inc. (44%), by the Pora family and Rol-Land Farms (30%) by the Vander Pol family, plus the President, Frank Ferrarrelli (11%).

### *1.4. Rol-Land's current position and relationships*

When Rol-Land purchased Kingsville Mushrooms, Rol-Land Farms ownership interest in the shared marketing organizations also changed. In 1998 Rol-Land had the following positions in related companies.

- Essex Kent Mushrooms Ltd. (100% owned by Rol-Land) handled mushroom distribution in Ontario. Exhibit 4 shows Essex Kent sales by market.
- Essex Continental Distributors Inc. (29.2% owned by Essex Kent) was involved in the distribution of mushrooms and specialty produce in Quebec
- Cedar Springs Cherry Growers Inc. (25% owned by Rol-Land Farms) operated an IQF (Individual Quick Frozen) facility to process a variety of fruits and vegetables during harvest season.

## Exhibit 4

## Essex Kent mushroom sales

Month	Windsor	London	Sarnia	Montreal	Toronto	HEINZ	Omstead	Cannery 1&2	Cannery Buttons	Total
<b>Monthly Sales by Market April 1998–March 1999 ('000's lbs.)</b>										
April	52	106	44	372	209	9	0	158	26	976
May	51	109	38	335	253	0	0	119	0	905
June	49	105	38	374	241	0	5	249	375	1,436
July	47	107	38	407	263	0	0	121	12	995
August	46	109	36	366	283	9	0	135	36	1,020
September	52	110	37	438	266	0	1	37	0	941
October	54	91	41	468	260	9	0	31	9	963
November	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0
January	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0
Total	351	737	272	2,760	1,775	27	6	850	458	7,236
<b>Monthly Sales by Market April 1997–March 1998 ('000's lbs.)</b>										
April	52	111	52	442	189	0	0	139	0	985
May	61	130	61	538	272	0	3	57	0	1,122
June	56	108	54	397	233	0	0	136	0	984
July	51	117	53	285	176	0	0	87	0	769
August	51	105	48	316	172	0	3	71	0	766
September	53	109	40	222	153	0	0	34	0	611
October	63	118	43	344	166	0	0	122	0	856
November	57	106	39	298	168	9	0	106	0	783
December	66	138	40	375	151	0	0	71	0	841
January	61	110	43	354	148	2	0	133	0	851
December	66	138	40	375	151	0	0	71	0	841
January	61	110	43	354	148	2	0	133	0	851
February	50	95	34	304	117	0	0	75	0	675
March	52	102	38	398	188	0	0	121	0	899
Total	673	1,349	545	4,273	2,133	11	6	1,152	0	10,142

## 2. Supply chain operation

Hank's interests and concerns extended back from ECDI to Rol-Land Farms and its suppliers. Any new initiatives at ECDI had to fit with the entire mushroom supply chain from Rol-Land right through to the customer. Examining the supply chain from spawn to consumer reveals some of the challenges facing chain members. The mushroom chain begins with Sylvan Spawn, a large international producer of mushroom spawn. Rol-Land has been doing business with Sylvan Spawn for years and relations are good. This is in part due to the similar entrepreneurial management styles of the organizations and the amicable relationship between the presidents. Spawn arrives weekly at Rol-Land's two production facilities from Sylvan production facilities in Pennsylvania. It is stored in a refrigeration unit until it is inoculated into the prepared compost, beginning the growing process.

The process of producing mushrooms takes 11 weeks (see Appendix 1 for a description of the process). At Rol-Land Farms (the Blenheim facility), two to three of the sixteen

growing rooms are filled each week. The mushrooms grow for four weeks before harvest begins. Harvest occurs on a rotating schedule with two to three days of harvest followed by three to four days for further growth. Each room produces mushrooms for three weeks before being cleaned out and prepared for the next crop. Mushroom production in the last week is less than half of production in each of the first two weeks. Although both Rol-Land mushroom facilities had the same number of production rooms, the rooms at Kingsville were 4000 sq. feet/room compared to 2500 sq. feet/room at Blenheim.

ECDI orders were placed daily with Essex Kent by telephone. Essex Kent also received weekly reports on product sales by category and by customer. If required, these reports could be further subdivided by producer, linking specific deliveries to specific growing facilities. Essex Kent took no role in directing product from grower to customer and left all distribution and ordering decisions entirely to ECDI. Reports from ECDI were sent to Essex Kent on the mushroom trucks returning daily from Montreal.

Selling mushrooms was a time sensitive business. The mushrooms had to be allowed to grow to reach maximum size to maximize output. However, if they were left too long they would open and become #2 grade, taking them out of the lucrative fresh market and into the processed food market. Once picked, they were cooled and transported to market as quickly as possible. Mushrooms were harvested in the morning and packaged later that day at the same facility. Some were packed into 5 and 10 lb. boxes while others were packaged into 1/2 lb. and wrapped. Packaging capacity was approximately 20,000 1/2 lb. packages per day. They were shipped by truck to ECDI later that day to arrive in Montreal before 5 a.m. the next morning. Although Essex Kent acted as an intermediary between Rol-Land and ECDI, the organization never took physical possession of the mushrooms. It handled promotion, order entry, billing, and arranged transportation and delivery. When mushrooms reached ECDI they were either loaded immediately onto delivery trucks or stored in the warehouse. Shipments were made to Quebec City four times per week and approximately 30% of the total supply moved through to the Quebec City market.

For Rol-Land Farms selling into the fresh market was vital. Prices for mushrooms sold for canning and food processing were approximately one third the price of fresh mushrooms. Matching variable supply to demand was a tricky process. Mushroom production varied depending on the number of growing rooms harvested, the age of the crop, growing conditions and health of the crop.

Although much of the mushroom supply chain was owned by Rol-Land, strategic alliances played an important part in supply chain operations. Manure and straw were purchased and trucked to the mushroom plants in company trucks. Close to 75% of mushrooms sold by Essex Kent came from Rol-Land's own production facilities but three independent mushroom producers under contract to Essex Kent supplied about 3.5M pounds of mushrooms. All packaging was done at the individual mushroom plants. Essex Kent arranged all sales and coordinated shipments in five company-owned trucks. Two of the trucks were dedicated to the Montreal route. Both Rol-Land and the contract growers supplied mushrooms for ECDI. The ECDI joint venture seemed to be working well and the shareholders were confident it would continue to expand in both volume and product breadth. Growth in mushroom sales in Ontario and Quebec were expected to slightly exceed projected population growth rates

## Exhibit 5

## Sample weekly ECDI mushroom sales report (in units)

Mushrooms		8 oz. masters	No. 1 5 lbs.	Cream 5 lbs.	No. 2	Sliced masters	Cream masters	16 oz. masters	5 lbs. sliced	Total
Class A - Distributors	Qty	3,500	700	100	200	800	100	200	0	5,600
Class B - Chain Stores	Qty	7,400	400	0	200	1,500	100	100	100	9,800
Class C - Jobbers	Qty	300	800	100	1,400	100	0	0	0	2700
Class D - Direct Store	Qty	2,600	1,500	100	4,300	500	0	200	0	9,200
Class E - Wholesalers	Qty	1,400	1,300	100	2,800	100	0	0	0	5,700
Total mushrooms	Qty	15,200	4,700	400	8,900	3,000	200	500	100	33,000

of 2–4% annually. This was a result of changing consumption patterns—with increased preference for fruits and vegetables and less for meat.

### 3. The Quebec market

#### 3.1. ECDI and the Quebec market

There are two main population centers in the Quebec market, Montreal and Quebec City, located approximately 200 km apart. Three organizations dominated the Quebec market for fresh mushrooms, ECDI with 40% of the market, Agrisol (supplied by HighLine Produce Ltd.) with 35% and GDP (supplied by Leaver's Mushrooms) with 25% of the market. These organizations sell mushrooms to large retail chains, small independent retail stores, restaurants and various distributors, wholesalers and jobbers. Retail chain stores are the largest customers for ECDI. Mushrooms destined for these stores are mostly packaged in 1/2 lb. containers or sliced and wrapped. This differs from Ontario where the preference of retail stores is for 5 lb. cardboard containers or 10 lb. returnable plastic containers. Exhibit 5 shows the distribution of sales in a typical week by customer classes and product category.

Mushroom production in Quebec had recovered somewhat since its low point in 1989 but there were only two major producers in the province, Terra Mushrooms and Chambec. Total Quebec mushroom production in 1997 was approximately 10 M lbs compared to 65 M lbs in Ontario. In 1997, the market for fresh mushrooms in Quebec was 30 M lbs. Mushroom consumption had been growing at a rate of about 5%/year since 1992.

Continental and Essex Kent each supplied close to 50% of ECDI's mushroom needs. Originally, mushrooms were sold on a consignment basis by ECDI who retained a fixed commission. However, this gradually evolved to arms length sales from the partners to ECDI at prevailing market prices. ECDI would buy from other suppliers if neither Continental nor Essex Kent could meet its needs. Exhibit 6 shows a typical week's mushroom purchases and sales by ECDI.

## Exhibit 6

## Sample weekly ECDI purchase report

Source		8 oz. masters	No. 1 5 lbs.	Cream 5 lbs.	No. 2	Sliced masters	Cream masters	1 lb. masters	5 lbs. sliced	Total
Agri-Sol Inc.	Qty	300								300
	% of total	2.1%								1.0%
	Unit cost	10.15								
Continental mush.	Qty	9,000	2,000		4,200	2,400	300	500	100	18,500
	% of total	62.1%	42.6%		55.3%	80.0%	100.0%	100.0%	100.0%	60.1%
	Unit cost	10.05	7.35	7.5	6.25	11.25	10.85	11.25	7	
Essex Kent mush.	Qty	5,200	2,700		2,900	500				11,300
	% of total	35.9%	57.4%		38.2%	16.7%				36.7%
	Unit cost	10.05	7.35	7.5	6.25	10.85	10.85	10.05	6.5	
G.D.P. champignons	Qty			500						500
	% of total			6.6%						1.6%
	Unit cost	10.05	7.35	7.5	6	10.85	10.75	10.05	7	
Ravine mushroom	Qty		100			100				200
	% of total		100.0%			3.3%				0.6%
	Unit cost	10.5	7	7.35	5.75	10.5	10.5	0	0	0
	Total	14,500	4,700	100	7,600	3,000	300	500	100	30,800

From a company with five employees and \$8.5 M sales, ECDI had grown to almost \$19M in sales and eleven employees. Projections for 1998 were for sales growth of close to 10%. Exhibit 7 shows a comparison of ECDI revenue from April to October for the last two years. The company operated 5 delivery trucks and a warehouse of 16,000 sq. feet. Both the number of trucks and the warehouse were sufficient to meet ECDI's needs. Most of the company's \$200,000 in fixed assets were in the form of warehouse equipment. The rest were in computer and office equipment. The company had no long-term liabilities, a short term bank

## Exhibit 7

## Essex continental income statement

	Oct. 30, 1998 (7 months)	Oct. 30, 1997 (7 months)
	Year to Date	Year to date
Sales	9,950,000	8,900,000
Cost of goods sold	9,230,000	8,370,000
Gross profit	720,000	530,000
Commissions	24,000	28,000
Interest earned	2,000	0
Total gross income	746,000	558,000
Operating expenses		
Warehouse	411,000	409,000
Office	83,000	67,000
Administrative	97,000	85,000
Total expenses	591,000	561,000
Income before taxes	155,000	-3,000
Provision for income taxes	28,000	0
Income after taxes	127,000	-3,000

## Exhibit 8

## Projected ECDI sales by product line

Product	Projected 1998 sales
Fresh mushrooms	17,500,000
Tomatoes	1,000,000
BC tree fruit—commissions	75,000
Chestnuts	250,000
Miscellaneous	100,000

loan of \$20,000 and accounts payable of approximately \$100,000, amounting to only a few days sales owed to suppliers. With the exception of Botner's accounts receivable, trade receivables were usually on par or slightly higher than payables. Inventory at the end of a day was typically \$10,000.

One issue for management was the reliance of ECDI on the domestic mushroom industry. To reduce its risk ECDI had gradually added additional specialty products, broadening its product line. ECDI distributed a variety of fresh produce items including hothouse tomatoes and cucumbers, and specialty items that it purchased from outside suppliers. The company also acted as the agent for British Columbia Fruit Trees, selling BC apples, peaches and cherries. A breakdown of the annual ECDI sales by major product line is presented in Exhibit 8.

### 3.2. The Montreal wholesale market

The Montreal Food Terminal where Botner operated was essentially a cash and carry market. Customers went to the market early in the mornings to purchase produce directly from wholesale companies. Sales in this market tended to be in bulk rather than packaged. Botner had operated a 24 bay wholesale outlet where it sold a wide range of produce. Botner's total monthly sales were estimated to be in the \$10M range. ECDI sales to Botner were over \$1M/year. Botner's main competitor at the market was Baisler Wholesale, another full line produce wholesale company. These two organizations had approximately 85% of the mushroom market at the terminal. Selling to Baisler would be difficult since the company had a long-standing relationship with Highline.

## 4. Rol-Land's options

### 4.1. ECDI-downstream expansion

The directors of Essex Continental were faced with a dilemma, should they wait and continue doing business with Botner, look for new wholesale customers or actually move a step further up the supply chain toward the customer by establishing a wholesale business. The option of doing nothing would mean giving up over \$1M in sales annually. At the time, prices and profits from sales to the wholesale market were attractive. Mushrooms not sold in

the wholesale market could likely be sold in to the fresh market elsewhere, but if they weren't they would be sold into the canning market for about half of their production cost. ECDI President, Frank Ferrarrelli, had considerable experience in wholesale and favored establishing a wholesale division. A 2000 square foot outlet could be leased for approximately \$25,000/year, staffed with two to three people and managed by Mr. Ferrarrelli. If ECDI took that route, a decision on product line breadth would have to be made. Botner and its main competitor, Baisler, sold a wide range of produce. Lines carried by ECDI made up less than 10% of Botner's product mix and far less of its sales volume. A decision to broaden the product line could impact the final structure of the wholesale division and its relationship with ECDI. If other products were added it might be necessary to establish new alliances to ensure continuous supply. Frank thought that they could be successful by offering only products in their current line. The issue of structure and ownership had not been discussed but would have to be before any decision was made.

#### *4.2. Spawn production-upstream expansion*

Beyond the ECDI situation, Hank was considering two options for expanding Rol-Land's position in the mushroom industry. Initial investigations led him to conclude that a joint venture with a spawn production company like Sylvan (or someone else) would be achievable if he actively pursued it. The proprietary nature of spawn genetics and technologies meant that the joint venture would have to be structured with the spawn producer holding controlling interest (51%). The spawn company would supply parent stock plus research and development while Rol-Land would provide the sales and distribution capability. Canada did not produce enough spawn to meet domestic demand and so Rol-Land's facility would fill an import replacement role. Building a facility of optimum size would require an investment of \$10M and Hank's projections placed capacity utilization at the facility at only 60% in the short term. There were only two other spawn plants in Canada. One was owned and operated by Highline while the other was a small independent facility in Quebec. Since Rol-Land would use only about 15% of the total production, sales to other organizations across Canada would be critical. Hank thought that most sales could be handled through Essex Kent's distribution system but he was unsure how well they would actually fit since Essex Kent's focus was provincial rather than national.

#### *4.3. Rol-Land production-horizontal expansion*

Hank was also considering expanding the Kingsville plant to add another 35% to total production capacity. "The market is basically undersupplied. I know I could sell most of those mushrooms." The expansion Hank envisioned would add 3M pounds of production capability to Rol-Land at an estimated cost of \$4.5M. Although free trade had opened the border for mushrooms, Hank was reluctant to enter the U.S. market, "They are so huge and you have to be able to supply large volumes continuously. I don't think that we are quite there yet."

#### *4.4. Supply chain improvement*

As Hank pondered the current situation, his major concerns revolved around Rol-Land and its role in the entire supply chain. He wasn't sure how much further he should stretch Rol-Land's reach at that time. The company's production and sales had grown tremendously but operating systems were essentially unchanged. Hank and his brothers were carefully monitoring Rol-Land and Essex Kent production and financial data but he knew that he could not say the same about performance assessment through the complete mushroom supply chain. There were a number of obvious inefficiencies and imperfections in the system. Bringing spawn in from the U. S. exposed the chain to currency risks not present in the domestic chains of competitors. Distributing production among two internal and three allied mushroom facilities reduced mushroom health risks but required more co-ordination. Distribution did not appear to be as effective or efficient as possible. Essex Kent trucks had to make numerous stops to pick up and deliver product. The trucks that went to Montreal every day came back empty most of the time. Matching production to demand was a constant challenge. At times ECDI had to buy mushrooms from other producers, meaning lost sales for Rol-Land, while at others excess Rol-Land production had to be sold at a loss to canning companies. Packaging was uniform through the system and had recently been redesigned. While most comments on the new black packaging were favorable, feedback from Chinese stores in Toronto was that black was seen as unlucky among many of the Chinese clientele. Hank knew that there were numerous opportunities for improvement if he focused on current operations. At the same time, he was well aware that market opportunities were temporary and if Rol-Land didn't take advantage of them someone else would.

#### *4.5. Hank's dilemma*

Hank had to help formulate ECDI's response to the Botner situation but that response also had to fit with Rol-Land Farms' strategy and capabilities. He thought that it was time to review the Rol-Land strategy for its mushroom supply chain. Should management focus be on improving the current system or expanding Rol-Land's reach? Were the two mutually exclusive? Whatever he did he knew that he needed to get a better handle on the performance throughout the entire supply chain. Recent events were forcing him to start at the end closest to the customer. To Hank, the customer seemed to be the best place to begin thinking about a supply chain.

*Note:* Case related supply chain readings and photos of mushroom production at Rol-Land Farms can be found at the ECDI case web page at [www.uoguelph.ca/~dsparlin/cases/cases.htm](http://www.uoguelph.ca/~dsparlin/cases/cases.htm).

*Teaching Note:* Instructors may obtain the ECDI Teaching Note by contacting David Sparling at [dsparlin@uoguelph.ca](mailto:dsparlin@uoguelph.ca).

## Appendix 1. Mushroom production

Week 1 –Mix wheat straw, horse manure, turkey manure and water to get a mixture which includes 72% water and 1.8% Nitrogen. This base material is rotated and mixed with a front-end loader every second day. The heating of the compost starts at this point.

Week 2 –Mixing continues and water is added to replace moisture lost by evaporation.

Week 3 –The heating compost is placed in long rectangular piles (called ricks) and mixed further and adjusted for water content every second day with a specialized compost turning machine.

Week 4 –The compost is moved into large enclosed kiln type structures. The perforated floors allow for air to be blown through the compost to stop the development of ammonia gas generated by the composting process.

Week 5 –The pasteurized compost is inoculated with spawn and begins to grow.

Week 6 –mycelium continue to colonize the compost

Week 7 –the compost with the fungus growing in it is moved to the growing rooms to begin the production phase.

Week 8 –Growth continues in the growing rooms but at a predetermined time the environmental conditions are changed and the fungus is forced to go from the vegetative stage to the reproductive stage of its life cycle. (The mushrooms we eat are the reproductive portion of the fungus.)

Week 9 –Harvest commences and usually lasts 3 days with a 4 day interlude for watering and growth. The expected yield is 2.5 lbs/day/sq. ft.

Week 10 –The second crop (flush) arrives and is harvested using the same schedule. Production volumes are similar to those of the previous week.

Week 11 –Third and last harvest is take. It is much smaller than the previous two, approximately 1lb./sq. ft. is harvested. The remaining compost is killed using high temperature steam. The material is removed, the area is sanitized, and the process starts over.

Mushroom production is a continuous process with a crop starting and finishing each phase of the process each week. The growing environment is carefully regulated with computer-controlled heating, air conditioning and air exchange. Theoretically, production can be expected to be constant year round. In reality, this is not the case.