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Supporting Egypt's Processed Foods Export Industry

Seed Varietal & Cultural Practices Test Plots Report - A Constraint to Exports

Prepared By
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Executive Summary

Egyptian food processors face a series of constraints in their supplies of raw materials for processing. Those processors that are not vertically integrated are reliant on several sources for their produce – direct from the farm, through wholesale brokers or from wholesale markets.

Few processors utilize contract growing as the growers, according to reports to ALEB, do not always honor contracts, usually in the face of better market conditions at the time of harvest. We must assume that this is a two way street, but processors do not admit to breaking their contracts. Some processors impose a 10% to 15% penalty for breaking the supply contract and report that it is sometimes paid, but more often, it is not. Other supply constraints are imposed by cooperatives, as in the case of onion growers. One large dehydrator reports that a cooperative controls 75% of the supply, and thus the price. Other constraints in the supply chain are the "galabeya mafia", a group of about twelve to fifteen wholesalers that control a large part of certain commodities or a significant portion of output in certain growing areas or governates. These wholesalers are well organized, supplying inputs to the small farmers in the form of seeds, fertilizers, pesticides and information. Reports are that they function better as an agricultural extension service than the official extension service!

If a processor is unsuccessful in securing produce through either of the above channels, they resort to the wholesale markets. Of course, this does not make economic sense, as processors must compete with buyers from the bakalas, supermarkets and other retail outlets for their produce, trying to pay a price that allows the processor to convert the produce, process it, package it and ship it to the consumer. While the retailer has no conversion costs and simply puts the produce on the retail shelf at a higher price, he can afford to outbid the processor for the higher quality produce. The obvious result is that the processor is forced to purchase "seconds" and "thirds" that the consumer would not buy on the retail shelf. While blemishes or misshapen produce are not a problem for the processor, overripe or under-ripe produce is, imposing high conversion ratios and forcing blending, which creates a whole new set of problems in meeting consistent specifications to get a final product.

And one of the largest problems is the lack of good agricultural practices and postharvest handling. Besides low yields as a result of poor cultivar selection or availability, the lack of a cold chain is reported to cost the agricultural sector LE4 billion annually. When one removes the life support system from a fruit or vegetable, e.g., harvest the produce, it starts the rotting process immediately. The rule of thumb in the produce business is that for every hour that the ambient field temperature is not reduced to impose a false dormancy, you lose a day of shelf life. This applies to processors as well. The "field to factory" time frame is as important to the processor as to the horticultural exporter, as it means higher yields, less waste and lower conversion costs.

pesticides is a problem that has been uncovered by BDS. There appears to be no facility in Egypt that is accurate in obtaining the proper soil analysis or petiole analysis for the growers.

There is little understanding of the proper usage of the various herbicides that are available to the growers. The growers now mostly weed the crops by hand, which costs about LE350 per feddan. Through proper cultivation and utilization of herbicides, this should be done for LE155 per feddan. This would result in savings of LE195 per feddan.

Recommendations

Eight vertically integrated processors had requested technical assistance in this area. Five were eventually selected to conduct seed trial plots. These companies were El Neniaea, Montana, Daltex, Kaha and El Roda Farms (P&J Co.). Contact was made with twenty-seven seed suppliers in the United States and Europe and seeds were brought in with the proper phytosanitary certificates and distributed without cost to the processors. This resulted in much consternation within the ALEB project among individuals with different agendas, but without purpose. According to the Agricultural Policy Reform Project (APRP) and officials at other Government of Egypt (GOE) agencies, private growers can bring in seeds for the purposes of research and demonstration (R&D). Seed cultivars that have demonstrated application in Egypt as a result of trial plots are carrots, tomatoes, corn and onions.

It is our recommendation that given the results of these past seed trials, emphasis concerning any further assistance on this issue be given to conducting further seed trials on a limited number of cultivars, including peas (petit poise), fancy, fine and extra fine green beans, cauliflower, broccoli and other varieties of okra that have more wide acceptance in consumer markets, rather than ethnic markets. Other seed trials could be conducted to validate viability for cultivation in microclimates in order to extend the growing season and thus availability for the processors. These seed varieties should include tomatoes and sweet corn.

Most of the focus should be placed on the provision of technical assistance in the areas of cultural and postharvest practices to increase yields and ensure product quality, and policy reform to mitigate or entirely eliminate the role of the GOE in seed selection and registration. Government restrictions and unnecessary, cumbersome regulatory oversight poses the largest constraint to progress in the selection and growing of proper cultivars that would reduce unit costs and gain wider acceptance in the market place.

And the most compelling need is to educate the processors on the requirements of proper cultivars over an extended period of the potential growing season to maximize their equipment utilization and improve their conversion ratios, thus reducing unit costs, as well as meet consumer demand in the target markets.

Introduction

In 1999, Agricultural-Led Export Businesses (ALEB) conducted an Industry Rapid Analysis (IRA) in Europe on agricultural processed products that were seen as potential products for Egypt to export to Europe (EU). Subsequently, many visits by this consultant and others from ALEB were made to Europe, the United States (US) and to the Middle East. Additional market profiles by commodity, by market were also developed. The analysis of these visits and reports were to assist ALEB in determining who the customers were in these markets and what were the products that had potential for export by Egyptian processors into these markets. The IRAs and the ALEB team identified numerous products. Some of the products that were identified were frozen and dehydrated vegetables, and tomatoes in the paste format; these vegetables were as follows:

1. Broccoli
2. Cauliflower
3. Baby Whole Peeled Carrots (Imperator type carrots)
4. Fine Beans
5. Artichokes
6. Asparagus
7. Petite Peas
8. Sweet Corn
9. Onions, dehydrated and regular to be used for dehydration
10. Processing tomatoes

I was requested by Mr. Douglas Anderson to come to Egypt to assist ALEB as a marketing expert from the background that I had in private business in the United States. I have assisted numerous companies in establishing Export Market Plans in my consultant periods in Egypt. In assisting the processors in establishing an Export Market Plan, I took note that the products that were listed by ALEB as potential export products were either not being processed by the agroprocessors or if they were, the agroprocessors were processing incorrect varieties. Customers that I met in the EU and the US told me and other ALEB team members that the varieties for the aforementioned products that were being used by Egyptian processors were not the ones that the EU, US, and the Middle East required.

I discussed this with Mr. Douglas Anderson and Chief of Party of ALEB, Mr. Dennis Buda. In my discussions with them, I stated that for Egypt to be competitive in the international market with the above products, that the correct varieties must be grown and the proper agronomy practices be utilized by the agroprocessors and/or growers. The results of the discussions were for me to assist the vertically integrated agroprocessors in obtaining correct seeds for processing of the aforementioned vegetables and to plant test plots in Egypt with the agroprocessors in various locations and, further, to assist the agroprocessors with the agronomy practices of the growing of these various crops. This agronomy would include area selection, time of planting selection, soil selection, cultural practices, harvest and post harvest handling. In my review of these aforementioned requirements, I determined that many of the processors are extremely inefficient.

It is the intent of this consultant in this report to address the market potential and underlying domestic constraints that exist in the EU, US, Gulf States and Asia for the aforementioned products. In order to gain market share in these markets, Egypt must change its approach to its operations and various laws and procedures in Egypt must be changed or modified. Market potential exists for Egypt, yet Egypt is not able to take full advantage of the international market at this time due to wrong seed varieties and arcane cultural practices. I will address all of this and illustrate to the reader the need for change and amelioration of cultural practices and seed varieties if Egypt is to overcome this lost opportunity.

Guatemala, Chile, China, Morocco, and South Africa. Egypt has a freight advantage on all except Morocco. Egypt has either equal or better soil and climate than any of these competitor countries. Egypt should have a freight advantage over the West Coast of the USA, which is the single largest exporter in this market and should take advantage of this strategic position.

The USA market is one that the Egyptian exporters can be competitive in and represents an import market of over $112,000,000 in frozen vegetables. I have singled out only the East Coast of the US due to its freight availability to Egypt. The West Coast is one where Egypt is not competitive because California and Latin America are able to be a price leader. Egypt currently exports almost $700,000 in frozen vegetables to the USA. Assuming the Eastern US market is worth $50,000,000, and if Egypt increased its market share three basis points, it would gain over $1,500,000 in increased exports.

The Gulf States is an area that Egypt should be very competitive with the market. But Egypt is not able to export much to these areas other than the traditional Arab frozen vegetables. The market for imported products is approximately $50,000,000 and the market share that Egypt has is approximately $4,099,000 or a market share of 8.1%. If Egypt were to increase its market share to 15%, the total would be $7,500,000, or an increase of $3,401,000.

The Asian market is another market that Egypt can be competitive in that does not exist at this time. California/USA has the largest market share in the economically advanced countries in Asia: Japan, Singapore, and South Korea. This market is $90,000,000 and the market share that Egypt has is almost nonexistent. If Egypt were to gain a 2% market share, then the total would be $2,019,600.

The total increase of the market share for Egypt is over $15,500,000. While this would not be realized in a short period of time, it can be accomplished. The self-imposed constraints that Egypt has placed on itself do not allow it to realize its full potential in the international market place. Egypt could make this a goal and do the necessary internal modifications to its agricultural program to achieve this goal.

The major competitors to Egypt for the aforementioned products in the EU are the USA, Brazil, Argentina, India, Turkey, China, and Central America. These countries constitute a majority of the extra-EU imports into the EU.

In the Gulf States, the countries for the most part are the same with the exception of the EU countries being a part of the market share. These countries have again the majority of the market share for imports into the Gulf States. This information is readily available in the ALEB reports constituting the Gulf IRA conducted by BDS in April 2000.

In the US, the countries for these products are many, but the majority of the products are imported from Canada, United Kingdom, Denmark, and Belgium, all high cost producers but productive, resulting in high quality products at competitive prices.

In Asia, again the USA is the major competitor and the others are China and Australia. These countries again have the majority of the market share on imports of the subject products.

Egypt has a freight advantage or should be competitive in most cases in all of these areas with the competition. Freight is not a reason for Egypt to be nonexistent as an exporter of the subject products to these areas.

The weather, soil and water in Egypt are generally very conducive for production of the above products. This consultant has not done all the due diligence that is necessary, but in

attributes are the ones freezing processors require of the most commonly accepted type of broccoli spears. Egypt cannot compete in the international market with the existing broccoli cultivars due to the lack of acceptable and required raw material. This is not only true in broccoli, but is true in the other seed varieties that I have listed above that make up the raw material component of processing. This is just an example of broccoli. It should be noted that one grower in the Owienat area has grown the Marathon hybrid variety, but could not find an outlet for it. Obviously, much education must take place with potential growers and processors to take advantage of these opportunities.

Varieties such as onions, fine beans, cauliflower, petite peas, sweet corn, and processing tomatoes are day length and weather sensitive. Therefore, various varieties have been developed to adjust to these weather vagaries and sunlight. In California, there are a multitude of seed varieties in each of the products that are used in order to enable the agroprocessrs to have the proper varieties for the time of the year that are being grown. In Egypt, for the most part, this is not being done by the various agroprocessors on any varieties. The advantage of this allows the agroprocessor to have a supply for a longer period of time and with the quality that will enable the agroprocessor to export.

The harvest dates will be extended and this is not only done by varieties, but by using the various microclimates that exist in Egypt. I have been studying the various microclimates and have discovered several that exist, such as Nobaria, Cairo, El Fayoum, Beni Suef, Sohag, and Salheya. There are differences in the temperature in these area; and therefore the varieties will mature at different times when planted at the same time. The microclimates will also allow the agroprocessors to have extended harvesting times, because the areas such as Nobaria are cooler in the summer and allow certain crops that are heat sensitive to be harvested there longer, such as broccoli and cauliflower, and in the Cairo area to be harvested in the winter where it is warmer, which allows the agroprocessor to have better quality in the winter.

In reviewing this, it is possible to harvest, as an example, broccoli from Mid-October through Mid-May. This would extend the harvest season and allow the agroprocessor to have a longer production season, and therefore reduce the production costs of the product. This would allow the vertically integrated agroprocessor to maintain high yields and quality. This is what is done in California.

This will reduce the conversion rates for the production cost because the agroprocessor will have the product over a longer production run and with maximum yield from the field. With a longer production run, the amortization of the machinery costs and other fixed costs are improved, therefore reducing the cost per unit of the final product.

With the utilization of the various tomato varieties as an example, the varieties are not bred for the fresh market, but for processing. The proper usage of the varieties will allow the agroprocessors to have tomatoes from Mid-February to Mid-September. The important factor here is not the yield, but the other factors that are very important in processing tomatoes, such as total solids, viscosity, bostwick, Ph, and brix. This is what the varieties must have to reduce costs in the processing plant. The tomatoes that are grown in Egypt for the most part are very low in total solids, in other words there is less for paste and more water in the tomato. Therefore, the cost of harvesting, hauling and removing water in the processing stage is more expensive. The total solids and/or brix for tomatoes in Egypt are 3.9%-4.1%, whereas the varieties that are being used for paste in California are 5.2%-5.6%. This would reduce the cost of growing, harvesting, hauling and production by approximately 40%. Such a reduction in costs would enable the Egyptian agroprocessor to compete profitably on the international market.

Yousef and myself with Dr. Seif and the HRI to assist ALEB in bringing in vegetable seeds for testing. I was to order the seed from the agents in Egypt or if there were not agents, then order the seed from the suppliers and have it shipped to Egypt in care of the HRI and Dr. Seif. Dr. Seif would go to customs and pick up the seeds and clear it through customs and take it to the HRI and then distribute 90% of the seeds to ALEB.

He was to have an agreement by the Governmental Seed Registration Committee, which he is a member of, and the Deputy Minister of Agriculture in order to have full agreement of the Egyptian Government. I was to plant the seeds in test plots with agroprocessors and he would plant the seeds at the HRI center in order to obtain registration of the seeds in Egypt.

We agreed that I could contact the seed agents in Egypt to discuss the method of bringing seeds into Egypt that we had agreed upon. I contacted the various seed agents in Cairo of the major international seed companies that I wanted to get seed from.

In my meetings with the seed agents, I learned just how difficult it was to import a seed variety registered in Egypt. Mr. Ahmed Fouad El-Taity of Suez Canal Trade & Agricultural Development, in a meeting with me on June 8, 2000 stated that it took three years to get the seed registered in Egypt. The HRI had to grow the seed in test plots in their center in order to determine if the seed was safe to have in Egypt. Mr. Ahmed further stated that it cost the seed companies LE 500-700 per year to have the testing done at the HRI. Once this was completed and the HRI recommended the seed to be registered, the aforementioned Registration Committee had to individually sign off on the seed. This was another cost of LE 4,000 or a total now of LE 5,500- LE 6,100.

At this time, his seed company, Royal Sluis, had a seed variety that had been approved by the HRI in November of 1999 and had not been approved by the Registration Committee because not all the members had signed the registration certificate. Royal Sluis had spent about LE 6,000 and waited now for almost four years to get one seed variety registered.

Mr. Ahmed stated that the international seed companies were very reluctant to register seed in Egypt because of the cost and the time it took to register the seed and the possibility that the seed would not be registered. He further stated the seed companies in many instances have new seed varieties developed by the time the seed is registered in Egypt. Therefore it is not feasible to follow the Egyptian format.

Another problem with the registration is that the seed is given to the Minister of Agriculture and it is assigned a secret number and delivered to the HRI. Due to this, the HRI does not know if the seed has a certain time of the year to be planted and the HRI might plant the seed out of season.

The seed is tested for yield and not for other factors that are now very important in varietal characteristics, such as taste, color, texture, and suitability for processing. If the yields are not good enough, then the seed cannot be registered.

In my meeting with Mr. Ahmed M. Roushdy of Novartis on May 31, 2000, he stated to me that onion seed is not even allowed to be brought into Egypt to be tested and registered by the seed agents. He stated that the Egyptian Government controlled this and wanted to continue to control the onion seed and not allow any seed to be registered for onions.

Mr. Ehab Ramsis of Samtrade stated on May 31, 2000 that his company had a test plot in conjunction with the University of Cairo to test seeds. He was able to get the seed into the country because he was using it on a single test plot. It was not registered, but was for testing only. He represents Seminis Seeds and California Seed Company and would not

In order to grow the aforementioned crops, the grower needs the proper machinery to properly prepare the soil, plant the crop and cultivate the crop. Lack of mechanical equipment in the fields that this consultant visited, which is in excess of 20, creates higher costs and decreases yield.

First, the soil must be prepared properly; this would include chiseling, disking, and listing. This would entail having the proper horsepower tractor and implements that would enable the agroprocessor to do such work. Typically, the agroprocessors and/or the growers that grow for the agroprocessors did not possess this type of equipment. Therefore, the soil preparation was done very poorly and the crop suffered in quality and yield.

Modern types of planting techniques were almost non-existent. Most agroprocessors transplant everything to the field. This is more costly and by studies done in California the crop is delayed by 10-12 days from maturity due to the shock of transplanting to the field. If there is a need to transplant, which at times there is, there were no proper methods of marking the spots to place the transplants. Therefore, the employees planting the transplants put the products at will wherever they wanted. This results in poorer yields because the plants need to be planted at specific distances apart in order to maximize the yields. The growers did not even possess a marker that would do this.

Alternatively, utilization of pesticides was a problem that this consultant discovered. There is no facility that is in Egypt that is accurate in obtaining the proper soil analysis or petiole analysis for the growers.

There is little understanding of the proper usage of the various herbicides that are available by the growers. Currently, the growers mostly just weed the crops by hand, which was about LE350 per feddan. Through proper cultivation and utilization of herbicides, this should be done for LE155 per feddan. This would be a savings of LE195 per feddan.

The art of cultivation does not exist in Egypt from what this consultant was able to witness. Cultivation is the process of opening up the soil for oxygen to penetrate the soil, which is necessary for the uptake of nutrients and photosynthesis. Various types of cultivating implements facilitate the removal of weeds. This is not expensive nor is it time consuming, but is very beneficial and cost-saving if utilized.

Soil sampling is a necessity for growing a good crop. The soil analysis will tell the grower what the soil needs and how to approach the upcoming crop for the necessary fertilizers and nematicides. Such assistance is very critical to controlling costs and to creating a soil condition that is conducive to growing a quality crop and with the highest tonnage possible. Generally, soil or leaf sampling will result in specific formulations to supplement existing nutrients at a reduced cost to the farmer in his annual fertilizer bill.

Harvesting and Postharvest Handling

Harvesting for the most part on all crops is done manually. Depending on the crop, it can be expensive. In California, onions, carrots, peas, beans, and tomatoes are harvested by machine. This will reduce costs and enable the grower to harvest the crop at any time of the day. While investment in harvesting equipment requires economies of scale, this consultant saw many farms that could justify this expense.

As an example, tomatoes are harvested in California at night in order to have the cooler time of the day when they are handled. There is less field heat in them in this manner, which will improve the quality of the fruit. In Egypt, the tomatoes are harvested by hand and done

showed him the carrots and he told me that I had the carrots in the wrong season and that was my problem, because if it was in the winter, this would not have happened!

In the test plots that I had, there were many vagaries such as this, yet I was able to prove that the products, for the most part, could grow very well in Egypt and at times of the year in some respects that all told me would not grow.

Dehydrated Onions

Dehydrated onions are one of the largest exported agricultural processed products that are exported from Egypt. The 1999 total exports of dehydrated onions from Egypt were $22.516 million, representing approximately 22.1% of the total processed foods exports for Egypt. The price has decreased from $1.63 per export unit value in 1993 to $1.19 per export unit value in 1997. This is a decrease of 25.8%. There is significant competition coming from companies in India, China, US (California) and Turkey. The price trend has continued to decrease in the last three years.

In 1999, the EU imported 24,142 MT of dehydrated onions from all over the world, worth US$50.5 million. Egypt's market share is 25%, worth US$11.286 million. If Egypt could increase their market share to 35%, then the total revenue for Egypt would be US$15.8 million. But Egypt is losing its competitive position in the EU market for dehydrated onions. Under current conditions, Egypt is not able to be competitive with the low international prices in today's market. In order to be competitive several changes in the growing, harvesting, and production cycle will have to substantially improve. In order to gain market share and to augment export revenue, then cultural practices must change and new seed varieties must be introduced.

Below are the countries that are the competition for Egypt and their amounts in Metric Tons that are exported to the world from 1994-97:

Country	1994	1995	1996	1997
India	16,331	21,428	24,120	24,000
US	10,076	12,288	22,209	18,489
Spain	11,846	13,149	14,523	15,426
Argentina	6,940	5,437	8,657	11,077
Uzbekistan	0	0	7,518	7,500
Egypt	3,416	8,253	7,848	6,935
Turkey	12,39	6,753	3,700	6,593
Iran	4,327	848	5,765	6,000

The inefficiencies that are existent in the Egyptian dehydration industry are many. The seeds for the onions that are being used are the Giza 6 and Giza 20 cultivars. These seeds are very poor and the purity has deteriorated substantially. There have not been any new varieties developed in twenty years. The current varieties grown in Egypt are responsible for lost revenue and inability to compete. The onions (Giza 6 and Giza 20) have a good aroma to it when they are dehydrated, but on the world market, it has to compete with the dehydrated onions from China and India. The onion that is grown in California (California grows approximately 90% of the onions used in the USA for dehydration) has a total solid content of 25%-30%. With the onion in Egypt being only 10%-15%, there is a distinct disadvantage to Egyptian onion dehydrators. Increased solids make the amount of moisture that needs to be removed significantly less and therefore gives the advantage to the global processors growing high solid onions.

The conversion factor of raw onion to dehydrated onion in Egypt is approximately 10.98 MT to 1 MT of dried product. In California the conversion factor is 4.20 MT per 1 MT of dried product. Therefore, as will be illustrated in this report, the costs of production are approximately double the cost of production in California. The onion varieties are not only the problem. Since India and China are copying the California method, Egypt is compelled to follow suit. The onions grown for dehydrating in Californian are white and the onions that

are used in Egypt are typically yellow. And poor cultural practices that result in reduced yields contribute to further increasing unit costs for the Egyptian processor.

Seed varieties need to be tried and developed in the Egyptian latitudes, 27-30 degrees. Latitudes determine the the daylight hours and onions are very senstitive to this. There are not a lot of varieties that are on the market for this daylight. The Horticultural Research Institute (HRI) can be very instrumental in researching this and developing cultivars that are most productive in the latitude and the growing areas which exist in Egypt.

The price that Egypt has been receiving for dehydratred onions on the international market for the last five years has been reduced to a point of no or very little profit for the industry. Below is an example of the average export prices received for Egyptian onions and domestic price comparisons, in US Dollars per unit:

Location	1994	1995	1996	1997
US	3.29	3.29	2.82	2.85
India	1.34	1.31	1.31	1.47
Hungary	1.79	1.92	2.16	1.55
China	2.25	1.97	2.74	3.18
Egypt	1.63	1.20	1.25	1.19

In an observation in the field, I took note of the fact that there are red, white and yellow onions that are in the seed mixture. There is only to be yellow in this variety. There are many sizes, which tell me that the seed lines are not being kept pure.

My neighbor in California, Mr. Tule Kreizenbech, is one of the top breeders of onions in the US. He breeds onions for many of the dehydrators in California. He told me that the Giza variety is a major problem for Egypt. Now I know why. The tonnage is poor and the solids are very poor. Therefore, the Egyptian processor is at a disadvantage in competing with other countries. If this is not changed, there will be no market in several years for the Egyptian processors.

The costs of dehydration are more expensive due to the amount of moisture that is removed from the onion. The cost of the raw material is significantly less due to this factor for the California onion. An Egyptian will need 10.98 MT of raw product to make one ton of dehydrated product, whereas California will need 4.20 MT of raw product to make one ton of dehydrated product. This is approximately 2.61 times the amount of raw material that is purchased by the Egyptian processor to attain the same results.

As stated in the earlier, dehydrated onions compute to 22.1% of all of the agricultural processed food exported by Egypt. The onion market share is going to be reduced significantly in the EU market if actions are not taken by the Egyptian Government to assist the growers to develop a higher quality seed that has a higher solid base to it. India, US, and China are going to take the market share from Egypt in the EU because they are using the higher solid varieties of onions.

The seed varieties that are utilized by California are proprietary. These are ones sold by Basic, and these could be used in Egypt. Available are White Creole, Creoso and Promero from Basic. The cost of the seed is high, but the results are very good. The seeds are bred for uniformity and are generally 2 1/4 to 3 inches in diameter. They are a white globe, high solids onion.

the soil. The reason for this is the soil is hard when the onions are harvested and there is a need to loosen up the soil so that the onions can be lifted by human hand from the soil without leaving half or more of the onion in the soil. I helped develop with El Neneaia a lifter for harvesting. The device that was built was less than $300.00 and the savings were significant. But it is not uncommon for a processor, after buying a field of onions, to leave them in the ground or dig them, lay them on the ground and cover them with grass for storage purposes. This can result in shrinkage of 10% to 15% in the first month and 5% every month thereafter until processed, further diminishing returns and increasing final unit costs.

The growers require cultural assistance by the extension services of the Egyptian government. The cultural practices utilized by the growers are very inferior and antiquated, therefore causing higher costs and loss of field production. ALEB, ATUT, APRP and/or a trade association representing the growers and processors should lobby the appropriate government agencies to understand this and assist the government in better implementing a program of proper extension service assistance.

In a visit to the farms of El Neniaea in El Fayoum and of El Nasr in Soheg, the cultural practicee are archaic and the yields are very substandard compared to those in California. The growers are not using any of the standard practices that are being used in California. The list would be very long if I illustrate each one, therefore I will only give what I consider some highlights.

The growers in Egypt apply their fertilizers by hand, that is, spreading the fertilizer as they walk down the rows. This allows a very poor uniform application to the plants and the plants will not grow uniformly. By utilizing mechanical equipment with a spreader attached to the tractor, uniform applications of fertilizer will enable the plants to grow uniformly, increasing yield and uniform size.

A backpack sprayer, one that is carried by an individual, performs pesticide applications and this individual sprays at random on the crop. If the material that is being applied is an herbicide, then there are places that will not be covered and others that will be too heavy. The light spots will not kill the weeds and the heavy applications on spots will do plant damage and possibly kill the plant. The same practice applying insecticides provides the same results - heavy spots will cause plant damage and the light spots will not eliminate the insects.

Many of the growers do not use any herbicides to remove weeds and they remove the weeds by hand. This costs them approximately $300.00 per acre. This does not include the damage that is being done by the laborer when removing the weeds and stepping on the plants or pulling the plant loose from the soil while removing the weed. California uses various herbicides, and the average cost per acre is $110.00 per acre. This is a savings of $190.00 per acre.

Presently all onions for dehydration in Egypt are transplanted, which creates a high cost. In California, all onions grown for dehydration are planted from seed resulting in low cost for growing. The reason Egyptian growers transplant onion plugs, this consultant was told, was for weed control. With proper utilization of herbicides, this is not a dilemma that would cause transplanting costs to be incurred, again reducing the growing costs of the growers.

All the onions are transplanted and this costs approximately $1,200.00 per acre. The plants are not evenly distributed because there are not proper markings for the employees to set the transplants. In California, the onions are planted by seed and with a precision planter that places each seed at the desired distance apart based on the time of year and region planted. This is one of the reasons for the increased tonnage (yield) in California.

There are various other factors that contribute to the improved tonnage of the California onions, but these are the highlights. The cultural practices are one of the reasons that the tonnage is 2 - 2.5 times that of Egypt, at the same growing costs per acre.

In order to make the onion dehydration industry more efficient in Egypt, cultural practices in Egypt must be improved. Processors need to have growing contracts directly with the growers, not through traders. This would enable the processors to have control of the seed, cultural practices, and pesticides that are being implemented by the growers, therefore increasing yields and quality.

All onions that this consultant is familiar with for the processors in California are grown under contract for the processors. The processors have "field representatives" in the field to help the growers and provide the seed in order to ensure control – yield and quality. This process needs to be investigated and implemented by the processors in Egypt in the future to control their own destiny.

Tomatoes

Processed tomatoes are imported in the EU, the US and the Arab States from outside countries. Egypt is an insignificant player in this product. There are many reasons for this, but I will only focus on the seed varieties and the cultural practices, which disallow Egypt from being competitive in the international market. A very similar scenario is true in the processed tomatoes that are in the dehydrated onions. Egypt is growing the wrong varieties, not utilizing the seasonal advantages of its climate and soil, and has inferior cultural practices to those of competitive countries.

The market for imported tomato paste by Extra EU trading partners into the EU in 1999 was US$54.252 million in value and 74,989 MT in volume. Egypt's market share in this is less than 1%. The international market presently on tomato paste is approximately $500.00-$600.00 per ton. In my research of the two processors that I consulted in Egypt, their costs were approximately $800.00 per ton. Egypt at these prices cannot be competitive, and therefore is exporting very little. The market may take some time to increase; therefore if Egypt is to gain a market share in the EU and internationally, Egypt must change the type of the tomatoes that it produces. In order to accomplish this, Egypt will need to start with the seed varieties and go through the operations of the product and marketing. I will focus only on the seed varieties and the cultural practices.

California exports internationally, not only tomato paste, but also tomato paste derivatives such as ketchup and tomato sauce. For purposes of comparison only and as illustrated below in the tables, there are significant markets for these products. And the market continues to grow as the world becomes more urbanized and per capita incomes increase. Based on growing conditions (water, soils and climate), Egypt could contribute to this market segment of processed foods. This, of course, is based on efficiency of the production and marketing, but without the raw material products being viable, then all is for naught. These are the export markets and values for the USA:

Product	Area	Value
Tomato Paste	Asia	$20,692,000
Tomato Paste	EU	$56,000
Tomato Paste	Gulf States	$196,000
Ketchup	Asia	$5,803,000
Ketchup	EU	$1,390,000
Ketchup	Gulf States	$1,568,000
Juice	Asia	$7,653,000
Juice	EU	$9,961,000
Juice	Gulf States	$3,669,000
Total		**US$50,988,000**

If Egypt were able to export 15% a much as California to these markets, then the total would be on an annualized basis:

Product	Value
Tomato Paste	$3,141,600
Ketchup	$1,314,150
Juice	$3,192,450
Total	US$7,648,200

This would increase Egypt's tomato exports to $7,648,200. The market is there, Egypt is not and I will provide the reason from the seed varietal and cultural practices aspects why Egypt is not competitive with the international competitors.

World tomato production estimated at 95.1 million metric tons in 1999:

Country	Percentage of World Total
China	19%
USA	10%
Italy	7%
Turkey	7%
Egypt	6%
India	6%
Spain	4%
Brazil	3%
Other	35%

Tomatoes are the most important crop grown in Egypt, but mostly consumed domestically. In Egypt the tomatoes are grown as one for fresh and processing. So a processor, like in the onions, is dependent on price from the fresh market. In California the tomatoes that are used for processing are only grown for processing and processors have a contract with the growers that is not dependent on the fresh market. California grows 94% of all the processing tomatoes in the US. This is one of the reasons that I will use California again as reference.

The tomatoes grown in Egypt serve a two-fold purpose. Like many developing countries, Egypt grows the same tomatoes for both the fresh and the processed market. This does create some opportunities for the processor, in that the processed tomatoes will not have the taste and the juice that fresh tomatoes have, attributes that actually increase conversion costs (low acidity and low solids). Tomato cultivars grown in Egypt are: Strain B, Honey Maker, Peto86, UC82 and UC97-3. These are old (less competitive) varieties that are not even used any longer in California.

The total acreage in Egypt is in excess of 340,000 acres, with a production of approximately 2.3 million tons annually. The average yield of Egyptian tomatoes is 17 tons per acre; California has a yield of 30.5 tons per acre. This is an increase of 79% in yield. The increased tonnage will reduce the growing cost per pound $.021 of raw material and with the factor of higher brix, this will reduce the cost per pound by $.03 or a total savings of approximately $200.00 per ton of finished of tomato paste. As one can see, there is a significant amount of room for the Egyptian growers and processor to build on and reduce costs.

Tonnage is not the only critical factor, the other factors are as probably more important in processing tomatoes than tonnage. It is incumbent on the industry to use varieties that are economically feasible to process.

The objective of improvement in tomato varieties is to improve the yield, soluble solids, cultural practices, and quality of the tomatoes in Egypt for processing. In a test plot that I grew with El Roda Farms, there were approximately 95 varieties planted and tested for feasibility of processing. All these cultivars were from California and were bred for processing only. When the cultivars were mature, the product was harvested and was tested at the laboratory of P&J, the processing facility of El Roda. There were certain cultivars that were found to be excellent in tonnage and brix.

One of the concerns that I had was Tomato Yellow Leaf Curl Virus (TYLCV). This is a virus that attacks the tomato in the heat of the summer. Some of the varieties that were in the test plot were TYLCV resistant and for the most part, I did not have a problem with the virus. This virus is transmitted during the hotter time of the year by the white fly, and since the test plots at El Roda were during the summer, I am confident that the varieties with the good results are fairly TYLCV resistant. Another concern was Tobacco Mosaic Virus (TMV). While this was a problem in the El Roda test plot, the high yielding varieties were generally not susceptible to this virus.

There were some of the cultivars that showed signs of Root Knot Nematode (RKN) problems. This was not prevalent in all the cultivars. There was RKN in the soil so the varieties for the most part were tolerant to the RKN. This is a significant savings per acre for the grower. If the grower does not utilize cultivars that are tolerant or resistant to RKN, then the grower has to apply a nematicide in order to counteract the RKN. California cultivars have RKN resistant strains bred into them and this was quite apparent in the test plot. I had some carrots that were in this test plot juxtaposed to the tomatoes, and they were totally contaminated with nematodes, therefore leading me to believe there was a RKN problem in the soil.

As with the dehydrated onions, the tomato seed varieties that Egypt is using are lower in soluble solids, which is referred to as brix in the tomatoes. The average brix for Egyptian onions are 3.8 - 4.2 per pound. In California it is 5.2 - 5.6. This is an increase of approximately 35% - 40%. In the test plot that I conducted with El Roda Farms, there were tomatoes that had a brix level of 6.5. These varieties were ones that are bred for paste in California, like Heinz. If extrapolated as above, this would be a difference of 50% for the highest test plot tomatoes.

Soluble solids, or brix, is a critical factor in processing tomatoes, as it determines conversion costs. Therefore, it costs 50% less to produce a pound of paste with the seed trial tomatoes that I grew with El Roda than the ones that are being grown by El Roda. The General Manager of P&J, Mr. Ahmed El Shafei, the processing arm of El Roda, assisted me with these figures.

Listed below are varieties that were planted on the El Roda farm and did well with brix, and did well in the California test I reviewed for viscosity. Although these were planted late and harvested after El Roda completed its harvesting of its tomatoes, the results were very encouraging. One of the important factors of the tomatoes is the viscosity of the tomato. This measures the thickness of the tomatoes when processed. In the international market this is very important to the purchaser. In Egypt it seems that the processors are more concerned about degrees of concentrate, but the buyers are more concerned about viscosity. The cultivars that were planted in Egypt also had a low viscosity (thicker) in California from the harvest of the 2000 crop. P&J did not measure the viscosity of the tomatoes that were processed.

California grows processing tomatoes from the Southern Central Valley to Yolo County, which is north of Sacramento, California. The average cost of producing a pound of tomatoes paste is $0.292 per pound, or $0.642/kg. This is a number that was generated by the largest processor in California - Morningstar. This includes the tomatoes that are contracted on a price and delivered to the facilities. The price of the tomatoes delivered to the facility is $0.194/lb., or $388.00 per ton of finished product. Therefore, production costs are $.098 per pound of finished product, $196.00 per ton. This is based on tomatoes that average approximately 5.25 brix per raw tomato. The table below illustrates the pounds of output as measured from the brix that are present in the tomatoes.

Brix	Pounds of product from one ton at 31 degrees concentrate
4	258
4.5	290
5	322
5.5	354
6	386
6.5	419

Using this as a guideline, and then using the tomatoes that are produced in Egypt of approximately 4.0 brix, the production costs would be significantly higher. Utilizing the costs in California, which are very similar to those at P&J for production, this would be a savings of $74.48 per ton in the production costs for tomatoes that are of 5.25 brix versus the 4.0 brix tomatoes in Egypt.

Another factor is the amount of tomatoes that would be needed; there would be a need for 35% less tomatoes for processing, therefore saving the processor a significant amount of growing, harvesting, and transportation costs.

In P&J's case, they grow a majority of their tomatoes; therefore they do not have the open market to compete with on the various prices. This is valuable for them, for they control their own destiny. They need tomatoes that are high in brix and low in viscosity. The varieties that I have listed are of this nature.

Tomatoes, like dehydrator onions, are sunlight and temperature sensitive. Various varieties are grown in order to maximize the yields of the tomatoes. Since I planted only one test plot with El Roda, I was unable to evaluate the tomatoes in different planting times. I planted tomatoes that were short day and medium day tomatoes, and kept records on them in the growing process. Some that are listed as this did okay, but I would assume that being planted in another time slot would do much better and give P&J a longer season to produce tomatoes and therefore reduce the operational costs due to higher volume. In discussion with Mr. Ahmed he stated that he would like to augment his season by another 45 days. Having the correct varieties planted at the opportune time can do this. Planting test plots in various microclimates and times of the season as I did, and then evaluating the results as was done with El Roda, can do this.

Egypt, blessed by their growing conditions, have two crops per annum. Tomatoes peak production periods in Egypt are June, July and August. Average production is in September. They have a crop with average production in December, January and February. November offers small quantities. They rarely have production in October (tail end of Summer crop) or

transport the tomatoes to the facility, and therefore the cost of $0.1914 per pound of finished product. Egypt does not do this for the most part, since the processors purchase the tomatoes on the open market and pay at times very high prices if the market is short and needs fresh tomatoes.

If Egypt were to buy all the tomatoes at the same price as California, but with the low percentage of brix (4.0), the cost per pound would extrapolate out to be $.02054 per pound of finished product, harvested by machine at a cost of $6.14 per ton. If the tomatoes that were grown and had high brix in the test plot with El Roda (6.25 brix), the cost of the tomatoes would be $.1318 per processed pound.

As one can see, the varieties that are used as test plots have a distinct cost advantage compared to the varieties that are being used by Egypt at this time. This is a savings per processed pound of $.1112 or $222.52 per ton; this would allow Egypt to be competitive on the international market with tomato paste.

In regard to the cultural practices of tomatoes in Egypt, the cost of weed control in Egypt is approximately $270.00 per acre. All the weeds are hand weeded and herbicides are rarely used. The cost of weed control in California is approximately $152.00 per acre, because herbicides and cultivation are used to keep weed pressure down. This is a savings of $118.00 per acre. Since Egypt is using the low brix and low tonnage tomatoes, this will be a higher cost for the processed product.

It should be the intent to work with various herbicides on the plants in order to determine which of the herbicides are the best results for the tomatoes. Various types of soil composition have different results with herbicides. In higher organic matter soil, like the Delta soil, the amount of herbicides would probably be less. There are herbicides that are lay-by, which means that they are not applied directly to the plant, ones that are a contact, directly applied to the plant and the weed, and pre-emergence herbicides. The combination of these herbicides and methods of application are what create the advantage that California has in weed control. These herbicides are available in Egypt, but are not used and when used are not applied properly. Herbicides that could be used are vapam, devrinol, and treflan.

Cultivation serves several purposes. This not only eliminates weeds, it opens the soil for the transfer of oxygen to the soil so that the microbiological activity can be increased.

Presently all tomatoes are transplanted in Egypt. In California, only 33% of the tomatoes are transplanted. This is significant due to the method that is used to transplant in Egypt. In the farms that I visited, there was not a measured method to transplant the onions or the tomatoes. The laborers planted the tomatoes at random in the soil or bed that was prepared for the planting. The desired goal of plants per 90 centimeters was 6, or each plant 15 centimeters spaced apart. This was not the case when I went to fields and counted the plants per 90 centimeters. I discovered from 4 to 15 plants per 90 centimeters. The reason for this is that the laborers have no guidelines on where to plant the transplants (plugs). Therefore, they randomly plant the plugs and have very little concern for uniformity of the plant spacing. The problems with these are many but the salient points are as follows:

1. The application of fertilizers and other fungicides will be inaccurate for the plants because each area will have a different plant population therefore causing erratic plant uptake or pant coverage.

2. Where the plants are quite thick, this augments the increase of fungal diseases. The reason for this is lack of air circulation as the plant is mature and overcrowding of the plants.

3. Precision cultivation cannot be done because the lines in which the tomatoes are planted are very incorrect and wander or "snake" down the bed.

4. Increased plant population causes what is known as vegetation and therefore the plant will not produce the proper number of flowers and not the desired product count, resulting in loss of yield.

Such problems will cause yield loss and increased cultural costs, and therefore increased cost of product sold. In California the transplants are planted with a machine and they are planted at the desired spacing of the grower. Manpower inserts the plugs into the planters, but the proper spacing is kept. For the plants that are raw seed germinated, the seeds are precision planted and the planter maintains a straight row that can be cultivated next to plants by the grower later. There is a process of thinning the plants to a stand by the growers.

In reviewing this, I worked with the growers to develop at least a marker to mark a spot in the soil that could be used by the laborers to plant the plugs. We did this at El Roda, and the results were very good. The plugs were planted in one-half the time as the normal plugs and 33% fewer plugs were used by the laborers. This will create savings by the grower. Now the plants were in a position to be cultivated. The marker that was built cost about $75.00. This additional cost was probably saved in the first acre that was planted.

The application of pesticides is the same on tomatoes as it is on onions. If an irrigation drip system is used for the tomatoes, then the fertilizer is applied through the drip and there is an even application of the fertilizer to the crop.

Concerning the pesticides (fungicides and herbicides), they are applied like they are in onions and there is little uniformity of application; therefore, like the onions there is a lack of proper control on the plants.

A sprayer can be used in all cases, since most of the pesticides are water-soluble. The savings here would probably not be in the costs of applications, but in the difficult measurement of yields and quality. As noted before, the yields in Egypt are 50% of those in California, so this practice and others contribute to the inadequate yields in Egypt.

Frozen Vegetables

In this section I will break down the vegetables in respective categories of: carrots, cauliflower, broccoli, peas, green beans and sweet corn. Since there are no export records that I could find of broccoli and cauliflower and carrots from Egypt, I will only deal with that which is imported to the EU. I will, in this section, illustrate the cultural problems with the aforementioned products, lack of proper seed varieties and cultural practices, and the potential for markets in the EU, Asia, Gulf States and the USA. Although the carrot cultivar that is discussed is new to Egypt, it is a variety of seed that is predominant in the US and due to the similarities of soil and climate to California; I am recommending that it be developed in Egypt for future usage.

Egypt has significant advantages in frozen vegetables and fruits; among those advantages are:

1. Availability of motivated and highly educated labor force at reasonable cost
2. Availability of the raw materials nearly year round for most of the items
3. Increasing attention to produce more and more vegetables and fruits, especially in the new lands and the major national projects in Toshka and East Owienat may result in availability of raw materials at reasonable cost.
5. Close proximity to major growing markets

Currently Egypt could be able to expand exports of different frozen vegetable items to the major markets in Europe, GCC and Asia-Pacific.

The market on imports from Extra-EU countries is very large on the crops aforementioned, with the exception of carrots. I was unable to locate any specific information on Baby Whole Peeled (BWP) or cut carrots. The consumption is fairly large in Europe, but I was unable to substantiate it for the EU. [Editor's note: One large California grower/processor currently conducting carrot trial plots in Spain estimates the BWP market in the EU at $350 million per annum.] EU consumers do buy a lot of frozen diced carrots, but this is produced *en masse* by EU processors and no one else can compete with the EU with this product.

I will illustrate in this section the potential of the markets for the products, then the problems that Egypt has in producing the product.

In the Asian market, I researched Singapore, Japan, and South Korea. Based on ALEB's preliminary market data from BDS, I was able to find enough material to determine that I think there is a possibility of market penetration for Egypt on all the products that I have listed for each of these markets.

Singapore imports peas, beans, carrots, cauliflower, broccoli, and sweet corn into the country. The major competitors for these frozen vegetables are the US, Australia, and Canada. Egypt can compete with N. America on freight, therefore making the market feasible for Egypt, everything else being equal!

Japan is a strong importer of the products and the major competitors are China, New Zealand, the US, and Australia. The difficulty here is the fact that three of the major competitors have a freight advantage that is impossible to overcome by the Egyptians. California has a 29.6% market share, but this is eroding to China. Japan is notorious for being a choosey buyer and in order to have any chance of penetrating this market with the products, Egypt must improve its quality significantly and lower its costs to be competitive. The growth of the frozen vegetables market in Japan is approximately 8% per annum.

South Korea imports 47% of its frozen vegetables from the US at a value of $2,519,670. The strongest competitor in South Korea now is China and is a formidable force. Since the project would not target substitution of US suppliers and it is likely that China will erode US market share anyway, if Egypt could position itself as a higher quality supplier than China, Egypt could potentially gain some of this market share. Egypt would have to have the proper quality in order to make any market penetration.

In the Gulf States, Egypt is exporting ethnic frozen vegetables such as okra, molokhia, and various frozen vegetables. Yet concerning sweet corn, peas, broccoli, cauliflower, and carrots, Egypt is not a significant factor as an exporter to this area. The major competitors are the US, Belgium, Denmark, and Canada, albeit, China and India are starting to export more to this market. Egypt not only has the better growing conditions than all of these areas, it has a significant freight advantage, as well as favorable tariffs. But as reported in the ALEB report by BDS concerning Gulf opportunities, quality of the product is not the only problem. There are other market constraints that must be addressed in order for Egypt to be competitive in this market environment that I will not illustrate in this section.

In the EU market, there is a large potential for Egypt. This is the market where the first ALEB IRA was done and the commodities that I have focused on are the commodities that are listed in the IRA. See the BDS report entitled *Findings of an Industry Rapid Analysis (IRA) of Trade, Market Trends and Opportunities, Volumes I and II, May 1999* for details on these commodities.

Unfortunately, given the time allowed for this report I was unable to find all the commodities as listed in the introduction in my research for importation into the EU market. But Table 10 in the referenced report indicates a US$181.483 million opportunity in frozen peas, green beans, sweet corn and mixed vegetables in seven indicator markets. Dried tomatoes represent a US$6.919 million opportunity in three indicator markets. Since Egyptian processors are not competitive with tomato paste, but could be, paste is included in the target commodities. Dried tomatoes require the same high brix cultivars that would be used for paste.

The growth rate in the EU is approximately 8%-10% per annum for frozen vegetables. The EU is a market that can be compared to the US market, in that the households are now families with two wage earners. Due to this, the utilization of frozen vegetables is now very popular and the trend is growing for ease of preparation of meals in the household. The major extra-EU competitors for Egypt are Thailand, the US, Ecuador, New Zealand, Poland, China, Canada, Guatamala, South Africa, Turkey, Kenya, Morocco, and Peru. These countries comprise about 90% of the extra-EU imports of frozen vegetables into the EU.

The US market is another market that can be penetrated on the East Coast. The product line importation for frozen vegetables are okra, peas, cauliflower, green beans, sweet corn and broccoli. However, while the current okra cultivar raised in Egypt is sufficient for the ethnic market, a different variety is more desirable by the largest number of consumers (in both the USA and the EU). More research needs to be conducted for okra cultivars.

Egypt will have a more difficult time penetrating this market due to the competition from Latin America. Much of Latin America has the same wage rates as Egypt and has very good growing factors. Many of the growers and processors are either trained in the US or have partners from the US or both. This gives them the advantage of efficiency and quality that is deficient in Egypt.

The markets exist for Egypt in frozen vegetables and it is up to Egypt to take advantage of. It is for Egypt to change and improve the ways that the crops are being grown and harvested. Countries such as China and India are doing this and their market share is

increasing each year. Egypt can have the internal resources that are necessary to do this, but must make the changes to adapt. I will illustrate the factors in each of the commodities in this fashion: a) broccoli and cauliflower, 2) carrots, 3) peas and beans, and 4) sweet corn.

Cauliflower and Broccoli

Broccoli and cauliflower are from the Brassica family. These two vegetables are very popular in the US and beginning to be very popular in the EU. There are some imports in the Gulf States and quite extensive to Asia. Presently Egypt exports little if any of broccoli or cauliflower. So there is a need to almost to start from the inception with the processors.

The type of broccoli and cauliflower that is grown in Egypt is what is called open pollinated (OP) varieties. The reason for this classification is that it is pollinated from one plant to another. This is not a hybrid, which has stringent and difficult pollination techniques, and the hybrid is what processors in competing countries use. The difficulty with OP cultivars is that they are no longer accepted in the international market because they do not have the intrinsic characteristics that create the quality of cauliflower required by consumers.

Cauliflower

Cauliflower is harvested and packed in florets and spears. It is important to have good color in the curds, heavy curds, no ricing, and curds that stick together. OPs do not have this. There are various varieties that should grow in Egypt at the time of year that is more opportune to plant them. Cauliflower (Brassica oleracea var. botrytis) that is frozen needs to be white and small curded. With the hybrid varieties, listed below, the hybrids have very small curds and the color is very white. The shoots are very small and therefore are the cultivars that are internationally accepted. The cauliflower that is grown in Egypt is one that is large curded and the color is an off white, more towards the brownish color and very ricey in texture. This is not acceptable on the international market. When clients try to export this, even to the Gulf States, the customers do not accept it. The international varieties that are acceptable are as follows:

Variety	Seed company
Snowcrown	Taki
Snowmistique	Taki
Ncline	Sakata
White Magic	Petoseed
Symphony	Novartis
Glacier	Sakata
Casa Blanca	Pybus
Shasta	Novartis
Chieftain	Petoseed
Rushmore	Petoseed

Head size on the hybrid cauliflower is about 15 - 20 cm. This is a domed shaped head. The OP is generally harvested at a larger size, 20 - 25 cm. The OP head is not domed shaped, but is flat, which allows moisture to collect and cause bacterial decay and discoloration. The new hybrids also are bred to allow the plant to "self wrap" itself in foliage to protect the product (head) from the sun. The sun light exposure to the plant head is one of the main causes of the browning. That is to say there are leaves from the plant that actually cover the head of cauliflower and do not let the sun shine on it and therefore keep it white.

Cauliflower is very sensitive to daylight hours and temperatures - more than broccoli. Cauliflower has an internal clock and based on the plant age and the ambient temperature that will trigger the curd to develop at a specific time. Varieties grown out of slots will not develop satisfactorily. Cauliflower can be either transplanted or grown from seed. A high percentage of the cauliflower grown in California is transplanted.

The cultural practices are the same with tomatoes and onions. Cauliflower is grown in Egypt, but the cultural methods to grow a good crop of cauliflower are very poor. What this consultant saw was grown in a very poor manner and little attention paid to good farming techniques.

Cauliflower is a crop that needs to be grown in the cooler times of the year in Egypt. It should be planted in the months of August through February. This would allow harvesting in the months of mid October through early April. As with the tomatoes and onions, there would be a need to move to the proper microclimate in order to do this. This would entail planting in the Nobaria area in August then moving to the Sohag area in September to November then back to Nobaria in December through February.

Sandy soil of the reclaimed desert land is okay for the cauliflower, but the crop does like heavier soil, like that which is in the Nile River historical overflow lands or the Delta.

Cultural practices as aforementioned with onions and tomatoes are practiced in cauliflower, and like onions and tomatoes need to be changed in order to be economical. Cultivation is one that is also necessary in this crop.

Proper fertilizer application and amounts is critical to the growth of the cauliflower. There can be petiole samples taken to determine the needs of the plant and this is something that is necessary to be done in order to keep the plant vigor healthy and maximize production.

In my discussions with representatives of Novartis and other pesticide handlers in Cairo, there are a sufficient amount of proper pesticides available for the proper application to ensure the quality growth of cauliflower.

Planting can be done with either a planter or by transplanting. As with tomatoes, there can be a marker designed that will allow the laborers to plant the plugs in the proper spacing. This again will allow precision cultivation.

If the cauliflower is planted by seed, then it can be planted in such a way that it will need to be thinned, but not in a major way to cause the cost of the seed to be high. Spacing is critical for the plants in order to get the maximum yield. Too thin will cause the head to be big and not allow the curd formation that is necessary for the international market. Too thick and it will be too small and cause fungal diseases to invade the plants.

Crops such as cauliflower must be grown with care and oversight to ensure that each detail is followed through with accuracy and at the proper time. This is a crop that cannot be planted and just grown with little attention to detail.

Cauliflower is hand harvested and great care must be taken not to injure the head, as it is harvested. Any bruising will show up later in the package. Cauliflower must be quickly cooled in order to keep the color from deteriorating. If placed in storage for processing, there should be humidity of 95%+ and a temperature of 0 - 2 degrees centigrade.

The growing costs of cauliflower are $1554.09 per acre in California. The harvesting costs are $2375.00 per acre in California. This should be an objective, in correlation to yield, for the processors to strive for in order to keep the cost of the finished product low.

Technical assistance is required to teach the processors how to grow these cultivars. Due to the cultural practices that have been mentioned heretofore in this report, the same reluctance to change has existed in cauliflower. If Egypt is to share in the international market for frozen cauliflower, then Egypt will have to grow the internationally acceptable varieties utilizing quality cultural practices.

The main competition for Egypt for cauliflower is the Latin American countries. The weather is good there and the labor is very low. Ecuador and Guatemala are the main exporters to the EU of this product. They are using the varieties that I have listed.

Broccoli

Broccoli (brassica oleracea) is another crop with a very good potential in the EU and in the Gulf States. The broccoli that is frozen is mostly in the shape of what is called spears or florets. These, like the cauliflower, are small pieces of the broccoli and they are to have short and thin shoots on them and small beads. Presently, the broccoli that is being grown for freezing in Egypt is OP seed and is not the variety that the international customers desire. The size of the head on the hybrid broccoli is 7.5 - 12.5 centimeters – small and tender. The head of the OP is 15-18 cm.

The OP is one that is large in the beads and the shoots and the head are flat and large. The surface of the spear is rough whereas the hybrid that is being grown in other areas for freezing is a small and tight beaded type. Broccoli from the OP is very flat and this can cause moisture to gather on the beads and head and cause fungal and bacterial problems. The hybrids are bred to be dome shaped and therefore the moisture will cascade off the head and not cause the bacterial and fungal problems.

Varieties that are being used by other countries for the frozen broccoli are hybrids. None of these varieties are being used legally in Egypt. There is one company that is illegally using the top variety listed below in order to have frozen broccoli for the international market. Below are listed the cultivars and the seed companies:

Variety	Seed Company
Pinnacle	Taki
*Marathon	Sakata
Centaruro	Taki
Legacy	Seminis
Patriot	Sakata
Triathalon	Sakata

* This is the most predominate broccoli that is being used and is the one most of the customers prefer due to its tight beads, small shoot and good color after freezing

The hybrid varieties are bred for a single harvest and therefore, the costs of harvesting are reduced significantly. The OPs are randomly harvested and generally it will take five to six times through the field to harvest the crop, therefore increasing harvesting costs.

The hybrids have a very tight and small bead in the heads and there is very little flowering or looseness of the bead. The tightness of the bead and the color of the bead are very important to the international customer. The OPs cannot offer this in the head and cannot supply the frozen product for the international customer.

1. Diameter to length ratio - the idea is to keep a relative good size from crown to tip on the carrot
2. Small core - 10% of the size of the carrot in diameter and good deep dark orange
3. Sweetness of the carrot - to be very high in brix for a carrot, 5%
4. Crown attachment - top health and size, good crown attachment so that the carrot can be harvested by the tops from the soil and that the tops are good and healthy and show no signs of fungal problems
5. Smoothness - the surface of the carrot very smooth so that the carrot has less surface to be peeled from
6. Length - more length, the more cuts

The carrots in the test plot that met or exceeded these requirements were several. They are as follows:

Variety	Seed Company
Sweet Pick	Asgrow
Sweet 16	Sunseeds
Sugarsnax	Sunseeds
HM03	Harris Moran
1907	Bejo
Pacific Gold	Sakata
Indiana	Bejo
Caropak	Asgrow
HM02	Harris Moran
Sweetbites	Sakata
1812	Bejo
Primecut	Sunseeds

These cultivars need to be tested on a year around basis to see how they do in different types of weather and daylight. Carrots are not sensitive to daylight hours and temperatures as are other crops i.e. tomatoes, onions and corn. Certain varieties can be planted throughout the year without any loss of quality; it will just take those varieties longer to mature if it is the winter months that the carrots are growing. Carrots are sensitive to soil temperatures and will not grow when the soil is too hot or too cold.

The soil that is necessary for Imperator carrots is one that is sandy and has good drainage to allow the carrot to grow long and smooth. The desert soils have this and are very conducive for carrots.

The cultural practices on carrots would have to be taught to the growers. There is need to make sure the soil is good and loose very deep in order for the carrot root to grow down deep in the soil. The carrot root must be able to go down approximately 42" in order to get the maximum length from the carrot. This takes deep tillage equipment and the ability to keep the soil soft for the growth of the carrot. The soils that I have looked at in the desert-reclaimed areas are quite conducive to this. Carrots are somewhat tolerant to Ph, in the range of 7.2 - 7.8.

Cultivation and spraying of carrots are very important and the proper equipment is needed to do this. Carrots are planted about 1.45 million live seed per acre, so there must be a planter to plant them in order to get the planting of the seed correct.

Carrots can be either sprinkled or flood irrigated, but with the sand as a growing medium it is probably best to sprinkle the carrots. The costs to grow an acre of carrots in California are approximately $1,800.00 per acre. Harvesting is done with very large machinery and laborers never touch the carrots until they are in the processing facilities. In Egypt they can harvest by hand due to the inexpensive labor, but if the industry were to grow, there are small machines that could be purchased and utilized for the harvesting. The carrot is more tolerant to high temperatures once harvested, and can take long distances from harvest point to production point without damage to the quality of the carrot.

In conversations with the major suppliers of pesticides, the necessary pesticides exist in Egypt. There are a few like linuron (Lorox, herbicide) and Rovral (fungicide).

Cultural practices would be somewhat the same as broccoli and cauliflower, in that cultivation and spraying are needed to raise the crop.

Green Beans and Peas

The market for frozen peas and green beans in the EU and the Gulf States is quite large. The tonnage and value imported by Extra EU countries into the EU is as follows:

Product	Year	Tonnage	Value
Green Beans	1999	19,331	US$12,116,000
Peas	1999	16,114	US$11,783,000

The major importers of green beans are Germany, followed by France. The major importers of peas are Germany, followed by the United Kingdom. These are markets that Egypt can target in the EU. Egypt is a very insignificant exporter (0%) of the products to the EU. If Egypt were to gain a 10% share of the market, the total value would be approximately US$2.39 million for Egypt on an annual basis for both products.

The Gulf States import green beans and peas and Egypt has a small market share in this market also. Egypt is only shipping approximately US$2,529,780 to the Gulf States. See the ALEB report by BDS entitled *An Industry Rapid Analysis (IRA) of Market Opportunities in the Gulf, Volumes I – VI, July 2000* for details on commodity opportunities in the these markets.

There are many seed varieties on the peas and green beans that are used in the US. Peas and green beans are grown for both fresh and processing in the US year round and in consideration for freezing, it would depend on the production schedule of the facility. California is not one of the leading states for peas and green beans, opting for higher valued cash crops. I was able to contact one of the leading firms that have numerous varieties in peas and green beans.

Peas and green beans like tomatoes and onions and the others, are daylight and temperature sensitive. Therefore, there are varieties that are used for the spring, summer, fall and the winter months. The important aspect of the cultivars is that they meet the requirements of the importing customer. As an example, the Germans, Swiss and French prefer a petite pea, which means the pea is about 6.25 mm or less. The varieties that are used in the US and in other countries have these characteristics. The variety must yield well and have the quality that is needed for the international market. In the US, those varieties that are used for processing are machine harvested, so there are characteristics that allow them to be better machine harvested. Egypt does not raise the cultivars that are essential in the EU or Gulf States markets for peas and green beans.

Generally, of what I saw of the cultural practices on the green beans and the peas that were being grown, I would state that there are practices that can be improved, but there is not the difficulty in accomplishing this as with the other crops. Most of the green beans and peas are planted by hand and the singulation is not good and the stand is typically poor. This could be improved by using a hand planter or a machine planter of some type. As referenced earlier, I brought back a significant amount of information on planters for these grower/processors.

The growing cost for green beans and peas are about the same, and the cost in California is $612.00 per acre. The harvesting costs are $108.25 per acre, but this is accomplished by machine and the beans and peas are harvested by hand in Egypt. The post harvest handling of the beans and peas is important to have them taken to the production facility in a period of the same day. There is a dehydration factor in peas and green beans that will denigrate the quality of the final product. In discussions with two of the processors that are clients of this consultant, I was told that they wanted to have green beans and peas at certain times of the year in order to meet production schedules and international sales. This can be done with the various varieties that are available for the market.

Sweet Corn

Sweet corn is a commodity that can be easily grown in Egypt. The weather is typically excellent for sweet corn. The soil is very conducive for sweet corn. The 1999 total for imports into the EU from extra-country EU on frozen sweet corn are 50,020 MT with a value of US$42.451million. Egypt has a very small market share - less than .1%, on sweet corn and if it could increase its market share to 5%, this would be a total of US$2.123 million in export dollars. This is either kernelled or frozen on the cob, cooked or uncooked.

The main competitors in this market are the US, Canada, and Israel. Israel is the leading exporter, but this is being reduced due to the fact Israel is reducing its exportation of vegetables. This is an opportune time for Egypt to gain that market share. The main importer is the United Kingdom, market share of 61%. The next market is Germany, 19%.

There is very little imported sweet corn into the US, which is very much a net exporter. The Gulf States are importers of frozen sweet corn and Egypt is a small provider of sweet corn to the Arab States.

With this market potential, Egypt cannot afford to pass up the opportunity of exporting frozen sweet corn to the EU and Arab State markets. But the reason that Egypt is not exporting sweet corn is because it is not grown, for all intents and purposes, in Egypt. Field corn is grown, but not sweet corn. The sugar content on sweet corn is much higher than field corn, and this is what the international market prefers. There are several varieties that can be grown in Egypt and are acceptable on the international market. Some varieties that are prevalent on the international market are as follows (see overleaf):

Variety	Company
8100Y	Abbott & Cobb
6800Y	Abbott & Cobb
8102 BC	Abbott & Cobb
8101Y	Abbott & Cobb
SS8101	Abbott & Cobb
7630Y	Abbott & Cobb
ACX525	Abbott & Cobb
RX452	Asgrow
RX601YG	Asgrow
RX670RR/YG	Asgrow
Bandit	Harris Moran
Sweetear	Harris Moran
HMX2384	Harris Moran
Sweet Dawn	Harris Moran

Sweet corn, like onions, tomatoes and cauliflower is very sensitive to sunlight and temperature. So like the aforementioned, different varieties need to be planted at various times of the season and in certain microclimates. Florida is the largest state in the US in growing frozen sweet corn, therefore with the latitude being very similar to Egypt, the varieties that are grown there would be very adaptable to Egypt. The varieties that are mentioned above are ones that are grown in Florida.

There are three genetic classes of sweet corn standard endosperm (SU), sugar enhanced (SE), and super sweet (SH2). The SU types are not as sweet as the SE and SH2 varieties and convert sugar to starch more quickly than SH2 types. The SE varieties have more vigor and are used when planting is necessary in the colder weather. The SH2 contain twice the sugar content that the SU varieties do, and the conversion of sugar to starch is slower and therefore have a better post harvest situation to SU and SE types.

In test plots this consultant conducted with clients, there were several of the aforementioned varieties that were found to be highly succeseful and one client now has contacted one of the seed companies, Abbott and Cobb, to import samples on a large scale to plant on their farms. They have successfully grown 17 feddans of sweet corn. Their laboratory analysis is attached in the appendix. There was a very extensive table of measurement used to determine the value of the corn. Several varieties did quite well; one did very well, ACX525Y. There are many other cultivars that could be planted, but I was only able to get Abbott & Cobb. The results are as follows (see overleaf):

Sample code #	Average weight per cob grams	Brix %	Statistical Data per cob				Average Length cms.	Physical Properties
			Weight Grams	Grain weight	Core weight	% grain to total		
8100Y	281.4	8	252.9	127	135.9	98.3	20	Yellow grains, fleshy
ACX525Y	329.9	9	395.5	253.3	192.1	54	22	Golden yellow, very sweet, fleshy, and soft and wet grains
7630Y	350.3	8	349.5	188.3	151.2	53.8	21.5	Yellow and fleshy, soft wet grains
ACX527W	258.5	8.5	267.3	154.5	112.8.	57.8	20	White, fleshy tender, juicy grains
8102	275.8	9.5	272.5	163.9	108.6	60.1	21	Yellow-fleshy, tender fresh

The ACX525 and 7630Y did very well and were bright yellow - the type of varieties that the client was looking for. Others were white or bicolor and therefore not ones that the client desired. There were some others that did not test as well, but they were short day varieties and therefore were not for the heat. These varieties were bred for the heat, as these corn cultivars used for the test were harvested on July 22, 2000.

Since there is no sweet corn for all and intents purposes, I will not go into any great detail on the cultural practices. Cultural practices are very different for sweet corn than for field corn. With one client, who grew field corn next to the sweet corn, I struggled continuously with the client to irrigate and spray the sweet corn on specific timetables. Field corn is not as needy as sweet corn. The growing costs for sweet corn in California is $1,356.34 per acre. The harvesting costs are $1543.75 per acre. This is a total of $2,900.09 per acre.

Harvesting can be done by hand or by machine. The varieties are bred to have uniform size for harvest and a machine can be used. Post harvest handling in the heat is very critical for corn. The corn can dehydrate very quickly and must be cooled as soon as harvested in order to prevent it from dehydrating. The kernels will shrivel quickly if allowed to remain in the heat.

Corn can be planted from December in the Sohag area and through August in the Nobaria area. This would give the processors a long season if it were needed. There would have to be testing in the areas to determine which variety is the best.

Corn is planted in a single row on a bed and can be cultivated very closely in order to prevent weed growth. There are many pesticides that can be used and all are available in Egypt, as we used several for the control of insect damage. I was very pleased with the control that was realized in this field with Montana and another with El Roda on insect control and fungal control.

Conclusion and Recommendations

One of the recommendations that need to be applied and practiced is the formation of a grower department for the processors. The strategy behind this is to have a department that has the responsibility to make contractual agreements with the growers and secure a supply of product at a fixed cost for the time that is required for the production cycle. Control can also be applied on the grower for the cultivars to be used in order to maximize the quality and the tonnage for the grower and the processor respectively. The grower can also institute the control for cultural practices in order to insure that the proper ones are executed to have the maximum tonnage.

All soils prior to planting need to be sampled and analyzed for the major and minor elements. The soil in Egypt is high in calcium and high in Ph, over 8 in many places in the reclaimed desert lands. Dr. Bill Liebhardt of the University of California of Davis states that this has been caused by over irrigation of the soil, in that it is saturated by the irrigation water and this causes the Ph and the calcium to increase. This phenomenon can be neutralized by the application of sulfur. The addition of magnesium is also recommended to neutralize the high calcium soil. With this condition, soil will not allow the plant to take up the nutrients that are placed in the soil. Certain high concentrations of elements, including calcium, "tie up" or bind nutrients in the soil, making them unavailable to the plant.

The Egyptian Government needs to change the requirements for importing seeds into the country. It should allow seeds to be imported and registered without burdensome regulatory constraints and testing. A phytosanitary certificate should be sufficient for seed imports, such as required in the US and the EU.

ALEB have within the scope of its contract the ability to assist the processor with seed varieties and cultural practices. As stated heretofore, Egypt will not be competitive on the international market without proper and cost efficient cultivars to compete with.

The individuals that would be used be for the proposed technical assistance should have practical experience as opposed to academic experience and can discuss with the growers the cultural practices that are needed for growing of an excellence crop. It is critical that the selected individuals have agronomic experience in California or places where growing conditions are similar in order to mitigate client resistance based on dissimilar growing conditions. It has been this consultant's experience, that the Ph.D.'s of the world have little or no practical experience and would not be valuable for all aspects of the cultural and seed selection that is necessary.

The present import taxes on inputs are excessive and the Egyptian Government must reduce the taxes. This will allow the inputs to be more economically feasible.

For the long term, an infrastructure of extension services needs to be established in Egypt, similar to the ones in California. This would allow growers and processors to have availability to the latest information and the assistance of those professionals at the extension service.

There is a large international market that Egypt is not presently penetrating, but could if the appropriate systemic changes were made in Egypt. So the changes need to take place in the government and with the processors and growers.

APPENDIX

Review of Field Test Plot of El Roda

On July 11, 2000 I went to the test plot that is being grown on El Roda Farms. I went to review the tomatoes and the corn in great depth. I spent all day in reviewing the tomatoes. The tomatoes are planted in five rows with all 91 varieties. Then the seed that is left over from these plots was planted in three replications in the field. 49 varieties were replicated. This enabled me to get a good appraisal of the varieties that were planted. I reviewed the tomatoes with the field supervisor, whom I know only as Mr. Ashraf.

I made an inspection sheet that was used to review the tomatoes. The sheet was based on the following: amount of set on the plant of tomatoes, size of the tomatoes, shape of the tomatoes, and the plant physiology and size of the plant. I utilized Mr. Ashraf to assist me on what he thought on the set of tomatoes, since he was familiar with the tomatoes that were grown by El Roda.

The review is to assist me in determining which of the tomato varieties were best suited to plant and harvest for this time of the year. The tomatoes were not ready for harvest, but I determined that I wanted to know which ones at this stage looked good and if there were any problems that I could see. The testing was as follows:

In the set count, I did this on a scale of 1-10. 1 - represented the poorest set of tomatoes, 5 – represented what I determined to be average, and 10 – represented that the plant has an excellent set.

In the shape, there are three shapes that are basically in tomatoes - round, pear shaped and long shape. Some of the tomatoes seemed to have a semi-round shape, so I listed some in that manner.

The varieties that we rated at 7 or over, I reviewed in the replications. I did not see the need to look at all the varieties again in the replications. I wanted to discover if the tomatoes in the replications were of the same quality in the different categories that I was reviewing.

The ratings were as follows (See Overleaf):

Variety: AP 793_____ Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	5-6	Pear 2"-3" in diameter. The size was quite uniform	Nice plant, nice structure. The plant was standing good and straight and had good color. There were not problems with any diseases

Variety: H 8892-7892-Q6_ Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	7-8	Semi-round. 1 1/2"-2 1/2". Fairly uniform	Big bush plant, it was to the point of being rank. The plant did protect the tomatoes.

Variety: H87046102 – M6_ Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	9-10	Pear 1"-2 ½" Fairly uniform	The plant is collapsing due to too many tomatoes on the plant. Still setting fruit and the plant has good color.

Variety: H2710917HF6-5_ Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	8-9	Pear 1"-1 ½ Fairly uniform	Plant holding crop well, not collapsing. The plant protects tomatoes. Plant is good color and large.

Variety: H715581HFTL6.5_ Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	8-9	Starting to turn color. 1 ½"-3" Pear	Plant is collapsing. Big plant and the tomatoes are mostly protected from the sun by the plant. Good color in the plant

Variety: H9492942QX6.5_ Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	4	Pear 1"	Big plant, good color

Variety: AP 676; Seed Company - Asgrow
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	6	Size is fairly uniform. The size was from 1"-3" Pear to Long	The plant was showing some curly leaf. I checked the roots by digging them up and I could not detect any nematode. It may have been the onset of TYLCV; I will be able to tell this later.

Variety: AP671_ Seed Company - Asgrow
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3-4	Long	The plant was rank and rangy in size. The color was good and no problems with any diseases

Variety: AP 5811; Seed Company - Asgrow
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	7	1"-3" The size was fairly uniform in size. Semi-round	Big plant, but had a small leaf. The tomatoes were on the lower part of the plant and were protected from the sun.

Variety: ACX 12A Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3-4	Round 1"-2", fairly uniform size	The plant was very large and rank.

Variety: ACX 12; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
5	5	1"-4" Sizing was not very uniform, shape was round	Big bush, but held its conformity. Good color in the plant

Variety: PJE633; Seed Company - Peto
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	7	1"-3" in size. The size was fairly uniform Pear shape	Some blight on the leaves of the plant. The plant was medium in size.

Variety: HP 513; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	4-5	Pear shaped, fairly uniform on the size, 2"-3"	Plant was very rank, too large. Plant had good color.

Variety: 2020; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3	Pear shaped; 1/2"-2"	Big plant, but not rank, the plant was holding together good and had good color

Variety: 1080; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	7-8	Semi-round, the size was not too uniform, ¼"-3"	Small to medium size plant, leaves were starting to curl. I checked the roots and I could not find any nematode damage, this again may be the beginning of YLCV.

Variety: 6235 Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	2-3	Semi-round, size was 1"-3", not uniform in size.	Plant was medium size, good color

Variety: #21; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	7	Pear, 2"-3", very uniform in size	Plant was collapsing and the tomatoes were exposed to the sun. The plant was a very rank and long stem.

Variety: HT 669 Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3-4	Pear shape, 1"-3" in size, not uniform	Plant was very rank.

Variety: 9665953HF2775; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	1-2	Semi-Pear	Rank and big plant

Variety: BOS8147 Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3-4	Round 1"-3"	Big plant, good color and structure

Variety: #25; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3-4	Long pear 2"3"	Plant structure nice and good color

Variety: #24; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	8	Long shape, size is 2"-3", length was from 3"-4". Fairly uniform in size.	Good plant in structure and color. Plant was protecting the tomatoes; most of the tomatoes were underneath. Plant holding its structure well. No visible signs of problems from diseases

Variety: #23; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	2-3	Pear shape 2"3"	Good plant

Variety: #22 Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	4-5	Semi pear, 2"-3" in size	Good color, nice plant

Variety: Gempack; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	5-6	Semi-pear, 2"-3" in size. Fairly uniform in sizing	Plant was rank, but not out of control

Variety: Super 528; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	6-7	1"-3", pear shaped to semi-round. The size was fairly uniform.	Plant protected the tomatoes. The plant was large but not rank, it had good color and did not show any signs of disease

Variety: BOS 8066; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	8-9	½"-3", Pear shaped. The sizing was not uniform, but the set was very heavy.	There was some worm damage to the plant. The plant was light in color. The plant was medium in size. Plant for the most part protected the tomatoes from the sun

Variety: HT183; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	7-8	1"-3", Round with most of the set on the bottom of the plant, and fairly uniform	Some wilt in the leaves or curling of the leaves. Check the roots and could not find any nematode damage, so may be the onset of TYLCV

Variety: HT 808 Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	7	1"-3" in size,Semi-round, fairly uniform in size	There was worm damage in the leaves. The plant was medium size and had fairly good shape, tomatoes were mostly protected by the plant

Variety: HT 865; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3	2" in size, Round, very uniform, but not many tomatoes	This was a very rank plant

Variety: H9425946; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	7	2", round, very uniform in size	Plant had collapsed, this was exposing all the tomatoes to the sun

Variety: H93147109 HF7 Seed Company - Heinz
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	7-8	1"-3", Pear shaped, size is not that uniform	Big plant with good color, there is a good set on the fruit

Variety: H9881957HF5; Seed Company - Heinz
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	9	1"-3", there is quite uniform sizing around 2", round shape ad the tomatoes are starting to turn color	The plant was structured such that the tomatoes were somewhat exposed. Plant had good color and medium sized.

Variety: H90356104M-7 Seed Company - Heinz
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	6-7	1"-2 ½", Good uniformity is size, pear shaped	Big plant but he tomato is protected. Good color in the plant.

Variety: H9559064219456 Seed Company - Heinz
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	5-6	1"-3", pear shaped. Not very uniform is size	Wilt in the leaves and the plant has started to collapse. I dug up the plant and there was no nematode in the roots. Beginning of TYLCV possibly

Variety: AP 391 Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	5-6	2"-3" in size and the sizing is very uniform. The shape is round	Nice plant with good size and thee fruit is protected from sun

Variety: HT 667 Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	6	2"-3" in size and the sizing is fairly uniform. Pear shaped	Big plan but it is keeping its shaped, good color

Variety: HT 806; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	7	1"-4" in size, not uniform in sizing at all. Pear shaped	The plant is very big and the tomatoes are starting to color

Variety: HT 809; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	6-7	1"-4", not very uniform in size, pear shaped	The plant was very rank, but the tomatoes were quite protected by the plant. Good color in the plant

Variety: Arieco Y; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3-4	½"-2" in size, fairly uniform in size, but small considering other plants, round	Plant has very little life and the leaves were wilted, I checked the roots and there were no nematodes. Poor color

Variety: HT 662; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	2-3	1"-3" in size, fairly equal in size, pear	Weak plant, color was very poor

Variety: HT 721; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3-4	½"-2" in size, quite small, pear shaped	Small plant

Variety: HT 721; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3-4	½"-3" in size, not too uniform in size, semi-pear.	Plant was very wink and was small, good color

Variety: #20; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3-4	1 ½"-3" in size, not very uniform, pear shaped	Rangy plant with good color.

Variety: #19; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3-4	1"-3", fairly uniform, round in shape	Big plant, real rangy, plant is too big for machine harvest

Variety: #18; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	4	2"-#", fairly uniform in size, pear shaped	Blight in the plant, wilt in the plant and worm damage to the plant leaves.

Variety: #3155; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	2-3	Pear shaped; 1"-3" in size, not very uniform in size	Plant is okay in color and size is medium.

Variety: #4077; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	1-2	1"-3", pear shaped	Large and rangy plant

Variety: HP 108 Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	7-8	2" in diameter and 4" in length, long shape, quite uniform in size	Plant not holding together that well, beginning to collapse. Most the of the set is underneath though, color is good on the plant

Variety: #8; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	2-3	1"-3" and not very uniform in size, Pear shaped	Light color and large plant, very bushy

Variety: #9; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	5-6	2"-3", not very uniform, round in shape	Leaves curling, checked and there was some nematode damage to the roots

Variety: #10; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	8	1"-2 ½" in size and fairly uniform in size, pear shaped	Good color, most tomatoes are inside the plant and protected from the sun, plant is very tight and good color.

Variety: #11; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	4-5	1"-3"in size, not very uniform, round in shape	Big plant and was very rangy.

Variety: #12; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	5-6	2"-3" in shape, fairly uniform in size, round in shape	Large plant and light in color

Variety: #13 Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	5-6	1"-3", not very uniform in size, pear shaped	The plant is light colored and small-medium sized plant

Variety: #4; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3-4	2"-3" in size, fairly uniform in size, Pear shaped	This is a large plant and had good color, leaves curling, dug up the plant and it was not nematode

Variety: #5; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	2-3	2"3", not too uniform in size, Pear	Big plant and good color

Variety: #6; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	4	2"-3", not too uniform in size, pear shaped	Very large plant, light in color

Variety: #7; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	1-2	1"-2" in size, fairly uniform, Pear shaped	Plant quite tall, not too bushy, light color

Variety: MHVF785F1; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	5	1"-3" in size and not too uniform in size, round in shape	Leaves curling, dug up the roots and there was no nematode.

Variety: VEGA F1; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	2	1"-3" in size, not too uniform, round in shape	Rank plant in size

Variety: HMX 4878 F1; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	6	1"-2" in size, quite uniform in size, semi-round in shape	Rank plant, but the tomatoes are protected nicely, good color to plant

Variety: FM 1115NP; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	9	1"-2", very uniform in size, semi pear in shape	Small plant, but the plant is protecting the tomatoes quite well. Good color to the plant

Variety: FMX1080 F1; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	6-7	1"-3", fairly uniform, semi pear shaped	Light color, most of the tomatoes were protected from the sun, medium size plant

Variety: FMX 1077 F1; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	6-7	1"-4", not very uniform in size, round in shape	Light colored plant and small plant. Tomatoes were fairly well protected from the sun

Variety: #9066; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	8-9	2"-3" in size, very uniform in size, Pear shaped	Medium size plant, good color. Most of the tomatoes were protected from the sun.

Variety: #1; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	6-7	2"-3" in size, very uniform, pear shaped	Plant is medium sized and in good shape, the color is good

Variety: #2; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	6-7	1"-3" in size, fairly uniform is size, round shaped	Some damage to the leaves due to worms on the leaves, the plant is large but not rank and good color

Variety: #3; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	5-6	2"-3" in size, very uniform in size, pear shaped	Light color and the leaves are curling, dug up the plant and it was not nematode, so might be the first signs of YLCV

Variety: #14; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3-4	1"-3" in size and not very uniform, pear shaped	Good color in the plant and medium in size

Variety: #15; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	7-8	1 ½"-3" in size, fairly uniform in size, round to pear shaped	Small to medium plant, not too bushy and some wilt in the leaves, color is good and tomatoes are exposed

Variety: #16; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	4-5	½"-3" in size, not uniform, pear shaped	Small plant with good color

Variety - #17; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	2-3	1 ½"-3" in size, round and fairly uniform in size	Small plant with good color

Variety: Gem Pride; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	2-3	½"-2" in size and fairly uniform in size, round in shape	Big bush and rank plant, laying down at this time

Variety: PJE633; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
78/11	8-9	2"-3 ½" in size and fairly uniform in size, pear shaped	Medium plants size and the tomatoes are somewhat exposed to the sun. The color of the plant was good.

Variety: HT 952; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	2-3	!"-3" in size and fairly uniform, pear shaped	Small plant, good color

Variety: H9387640Q6; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
57/11	2	½"-3" in size, not too uniform in size, pear shaped	Small plant and good in color

Variety: H938203956; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3	1"-3" in size, not uniform in size, pear shaped	Small plant and good color

Variety: H9176538 B1 2-8 Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	5-6	1"-3" in size, fairly uniform in size, Semi-round in shape	Plant has good color and is medium in size

Variety: H9175735STC7; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	3	½" –2 ½" in size, fairly uniform in size, Pear shaped	Plant has good color

Variety: H95539490B65; Seed Company _____
Lot #_____

Date	Set on the Plant	Size and Shape of Tomatoes	Plant Size and Physiology
7/11	7	1"-3" in size, fairly uniform size, pear shaped	Rank plant, with good color and protecting the tomatoes

In the replications the tomatoes were as follows and the set measurement were as follows:

	Replications & Rankings	Single Test Plot Ranking
HP 5811	5 - 6	7
PJE 633	6	8 - 9
H955390B65	6 – 7	7
FMX 1077	6 – 7	6 - 7
HP 108	8	7 - 8
HT 809	7	6 - 7
FMX1115	9	9
H9881957 HF5	8	9
BOS 8066	10	8 - 9
HT 183	8	7 - 8
HT 806	7	7
H9425946	8	7
FMX1080	6 – 7	6 - 7

This was all of the ones that had over a 7 or above that were replicated. As one can see, the replications were very similar to the single tests that were conducted. Further research on my part will be done to determine which of these were long day varieties and short day varieties.

All the tomatoes were green, except the ones that were taken note of with the changing of the color.

Corn

ACX525 – Still okay, but losing sugar and some of the kernels starting to shrivel.
SS7311 – Old and the kernels shriveling
Bandy – Long kernels and it is ready now. The ear is 6"-7" in length. The kernels are long and full.
SS8100Y – The Ear is 8"-9" in length and has long kernels and ready.
ACX527W – 8" in length and the kernels are somewhat mixture of yellow. Has a long kernel, not as sweet as SS8101W. It is ready at this time.
SS8101W – 8"-9" in length. The ear is long and full and the kernels are long and full. The corn is ready now.
SSSS7630Y – The ears are not uniform on the plant and kernels are not as long as ACX525. This is not quite ready and needs 3-4 more days. The ears are 6"-7" in length. Not a full ear as ACX525 is.
Jubilee – Ready, 6" in length and the sugar is very low. There is no weight to the ear, and the kernels are very small.
SS7901W – Ready, the length is 6"-7" in length. The kernels are long and fairly full.

Discussions

1. Gave copies of the farm implements to Dr. Mohamed. These included planters, spray rigs, cultivating equipment, and other types of field equipment.
2. Discussed with Dr. Mohamed the need to fumigate the carrots for the fall. He asked me if I thought that this was the problem with the carrots so far as the carrots roughness and the problems with the root hairs.
3. Discussed the fall planting and what El Roda wanted to plant. He stated on my next visit we would discuss this in detail.

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Montana

09 JUL 2001

To: ALEB. Fax:

Att. Dr. Manal KARIM Tel:

From: Fadel EL GUERETLY / Montana Date: 08/07/2001

Re: Sweet Corn Report Pages: 3 (three)

CC: Mr. Douglas ANDERSON

☐ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

Dear Sirs/Mme,

Reference to your request regarding Sweet Corn grown in our plantations from seed supplied from the USA through the ALEB Program, please find hereunder a brief historical covering our experience in growing sweet corn.

- Mr. David YOUROSEK brought samples to be tested in season 2000. Supplied by Abbot & Cob.
- Nine varieties were tested. Results were recorded as per attached (table a).
- Variety ACX 525 Y was selected based on brix and % kernel weight to cob weight.
- Based on these results *Montana* placed a trial order of 60 kgs to be tested in season 2001.
- Seeds were sown on: March 27th 2001
- Harvested in: June 2001.
  On a total area of: 17 feddans (1 feddan = 4400 m2)
  At the rate of: 3.5 kgs of seeds / feddan.
- Seeds were planted as follows:
  a- 1 1/2 cm deep.
  b- 20 cm apart.
  c- Rows about 65 cm apart.

- **Outcome of season 2001 crop as follows:**

-	Yield:	5 metric tons of cobs/feddan
	compared to	3 metric tons / feddan using local seeds.
-	Average brix:	12
-	Weight of kernels / cob =	48%
-	Insect injuries:	6 - 8 %
-	Fungal injuries:	10%
-	Average length of cob:	20 cms.
-	Average weight of cob:	240 grm.

Remarks:
Low resistance to Insect & Fungal injuries, although a very strict pesticides program was adopted.

Hoping that the information provided satisfies your needs. Have you any further inquiries, please do not hesitate to contact us.

Thanks & Best Regards

Fadel EL GUERETLY
General Manager
United Company for Food Industries
Montana

Table a

TEST SAMPLES

Item	Sample Code#	Average Weight Per Cob grams	Brix %	Statistical Data Per Cob				Average Length cms	Physical Properties
				Weight grams	Grain Weight	Core Weight	% Kernel to total		
1	8100 Y	281.4	8%	262.9	127	135.9	48.3%	20	Yellow grains - fleshy Tend to have dry grains
2	7901 W	263.7	7.5	253.0	143.5	109.5	56.7%	19.5	White grains - fleshy Tend to have dry grains.
3	8101 SS	256.8	8	272.1	161.5	110.6	59.3%	21	White/yellow - fleshy Less dry grains.
4	ACX 525 Y	395.9	9	395.5	253.3	142.1	64%	22	Golden yellow - Very sweet Fleshy - Tender & fleshy grains.
5	7630	350.3	8	349.5	188.3	161.2	53.8%	21.5	Yellow - fleshy Tender & fleshy grains.
6	6300	240.1	9.5	246.6	169.2	77.4	68.6%	20	Yellow - Some hollow grains. Tend to have dry grains.
7	ACX 527 W	258.6	8.5	267.3	154.5	112.8	57.8%	20	White/yellow - fleshy Tender juicy grains.
8	8102 BC	275.8	9.5	272.5	163.9	108.6	60.1%	21	Yellow/white - fleshy Tender & fresh.
9	8101 W	274.1	5.5	274.1	153.4	120.7	56%	20	White/yellow. Fleshy grains.