USAID FIRMS PROJECT

S.B. Chaunsa Mango Export Market Marine Container Trial Shipment to the Netherlands

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Abstract

A detailed description is provided of the protocols followed at mango orchards and packinghouses during preparation of the S.B. Chaunsa marine container trial shipment to the Netherlands. The quality of the fruit at arrival is described in detail, along with the comments of the importer regarding future market opportunities for Pakistani mangoes in the E.U.

The purpose of the report is to document in detail the steps followed in preparing the mango shipment and the resulting condition, appearance, and marketability of S.B. Chaunsa mango fruit exported by refrigerated marine container to Europe.

Acronyms

CA	Controlled Atmosphere
E.U.	European Union
cm	Centimeter
IBF	Pounds-Force
KGF	Kilogram-Force
USAID	United State Agency for International Development

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Executive Summary

Two GlobalGAP-certified farms in Punjab province were the sources of the Firms-assisted S. B. Chaunsa mango trial shipment to the E.U. by marine container. Both farms had recently completed their packinghouses and on-farm postharvest infrastructures. The fruit was harvested from each farm during the same 2-day period in the second half of July (July 19-20, 2011). One farm provided 8 pallets and the other 4 pallets, in order to fill the 20-foot refrigerated marine container. The S.B. Chaunsa mangoes were exported to Solfruit, a leading mango importer outside of Rotterdam, Netherlands. The interval between harvest and fruit arrival at the warehouse of the importer was 26-27 days. This was an undesirably long period of time, due to re-routing of the vessel and a late Friday arrival at the Port of Rotterdam. This added 6 more days to the scheduled arrival time.

The S.B. Chaunsa fruit from both farms arrived in poor condition, primarily due to the high incidence and severity of anthracnose and stem-end rot decay. Approximately 40% of the fruit had noticeable symptoms of one or both types of fungal decay. This can be attributed to a combination of high fungal inoculums concentration on the fruit at the time of harvest, plus the undesirably long arrival time. Refrigerated marine container transit times of more than 21 days will always be high risk shipments, with the likelihood of significant arrival quality issues. Use of low oxygen CA marine containers may extend the fruit market life an additional week.

Upon arrival, the skin color was mostly green, with noticeable discoloration and browning of much of the fruit. Approximately 25 % of the fruit exhibited some degree of skin discoloration. Sapburn stains were observed on about 30 % of the fruit in the container. Most of the sapburn stained areas were infected with anthracnose. None of the S.B. Chaunsa fruit had ripened to a uniform full yellow color. The green-skinned fruit did not ripen to a normal yellow color during the post-arrival period. Skin discoloration and browning continued to intensify in the post-arrival period.

Fruit flavor was excellent and characteristic of the S. B. Chaunsa cultivar. The fruit also arrived in firm condition, which was very desirable for the importer. The importer considered the fruit firmness to be acceptable for their retail supermarket clients. The firmness level was a significant improvement over the previous Sindhri shipment. This can be attributed to the lower 11.5° C transit temperature for S.B. Chaunsa.

The importer gave a quality rating of 4 (poor) to the overall marine container load of fruit, on a scale of 1-5. This was primarily due to the prevalence of postharvest decay.

The physical integrity of the load was good, with minimal carton collapse and pallet damage. The surface of the pallets contained enough boards to eliminate lower carton collapse. In addition, use of Styrofoam bracing material between the inner wall of the marine container and the pallets prevented load shifting during transit.

The high amount of postharvest decay on the S.B. Chaunsa fruit from both farms was a concern to the importer. However, the excellent taste, very high sweetness (average 24° Brix), and firm fruit were highly desirable characteristics. Internal pulp color was also a uniform yellow. The green skin color would not be an adverse fruit quality characteristic for marketing S.B. Chaunsa to the mainstream retail supermarkets. However, this would be a quality defect in marketing the fruit to Asian community consumers.

Solfruit remains very interested in receiving significant volumes of Pakistani mangoes next season. They are interested in receiving up to 30-40 marine containers (40-foot length) during the late-May to September harvest season. This represents a very significant market opportunity for a commercial exporter and combination of mango producers next season.

Preliminary data from the different experimental treatments indicated at least one of the postharvest fungicides can provide excellent control of anthracnose and stem-end rot. The use of this fungicide may be shown to be essential for the significant reduction of postharvest decay in Pakistani mangoes. If so, it may facilitate successful arrivals of S.B. Chaunsa mangoes by marine container to Europe and other distant export market destinations.

1. OBJECTIVE

The objective of the USAID Firms Project mango trial shipments is to obtain a high percentage of marketable fruit for European importers serving the mainstream retail supermarkets, using cost effective marine container transport.

2. INTRODUCTION

In order to realize the above objective, the USAID Firms Project has provided grower training in good agricultural practices and has cost-shared in on-farm packinghouse equipment, cooling, and cold storage infrastructure.

The long term goal of the Project is to develop and expand the market volume and value for Pakistani mangoes in European retail supermarket channels. This will require growers and exporters to provide consistent supplies of high quality mangoes at a competitive price. Marine container transport mode is prioritized, due to the significantly greater export volume capacity and lower transport cost associated with sea freight.

3. The TRIAL SHIPMENT

A Firms Project-assisted trial sea shipment of 'S.B. Chaunsa' mangoes to the Netherlands was made in late July through mid-August from two GlobalGAP-certified farms in the Khanewal and Multan area of Punjab province. The mangoes were grown at [redacted] and [redacted]. The fruit from both farms was harvested over a 2-day period on July 19 and 20, 2011. Each farm had recently completed installation of the packinghouse equipment, blast chiller, and cold storage.

Fruit Harvest Maturity

The fruit was harvested in the firm green stage, with an average Brix content of 6.5. The fruit pulp color was cream to light yellow.

Figure 1 Cream to light yellow pulp color of S.B. Chaunsa fruit at harvest

Harvest Conditions

The outside ambient temperature during fruit harvest ranged from 32-38° C, with 75 % relative humidity. The average internal pulp temperature of the fruit harvested in the morning was 33° C. Fruit harvested in the afternoon had an average pulp temperature of 36° C. There had been sporadic rainfall prior to harvest in both locations.

Harvesting Process

The fruit were carefully harvested using secateurs and picking poles and put into well-ventilated rigid plastic field containers. Approximately 5-7 cm of pedicel (stem) was left attached to the fruit.

Figure 2: Fruit harvesting, manual de-sapping, Fruit pulp temperature at harvest

De-sapping

The harvested fruit was manually de-sapped in the field, under the shade of the mango trees. The stem was re-cut near the shoulder of the fruit, while being held in an inverted position. The fruit was placed stem-end down on metal de-sapping racks and left to de-sap for approximately 3 hours.

Packinghouse Operations

After de-sapping, the fruit were put back into the rigid plastic field containers and brought to the packinghouse. The mangoes were carefully unloaded by tilting the field container so the fruit could roll onto the slowly moving receiving conveyor belt. Preliminary sorting/grading was done to remove the non-export market quality fruit. The fruit were then cleaned on top of a series of rotating brushes and overhead spray wash water. The fruit continued along the packing line and into a hot water tank maintained at 52° C ±0.5° C. The majority of fruit received a 5 minute hot water submergence treatment to reduce the incidence and severity of postharvest fungal decay. The fruit were then dried by passing over a series of rotating sponge rollers and through a forced-air tunnel. The surface dried fruit then moved into a collection area where it was manually sorted, graded, and packed in open-top corrugated cartons. A single layer of uniform-sized fruit was packed into each corrugated carton, which was manufactured by Arabian Packaging in Dubai. The gross weight of the 9-count cartons ranged between 3.45-3.85 kg. The gross weight of the 12-count cartons ranged between 4.05-4.50 kg.

The weight of the empty carton was 0.31 gm. The following photos illustrate the processes of sorting, washing and drying of the mango fruit before packing.

Figure 3: Sorting, Washing and Drying

The cartons were weighed, stacked on pallets, secured with 4 cornerboards nailed to the base of the wooden pallet, strapped tightly around multiple layers of cartons, and moved with a hand jack into the blast chiller maintained at 12° C. Each pallet contained 126 cartons, consisting of 14 layers and 9 cartons per layer (3 x 3 configuration). The same size fruit were stacked on a pallet, with the count per carton being 9 (medium size; 3 pallets) and 12 (small size; 9 pallets).

Cartons from [redacted] in Dubai were used for most of the shipment. Due to an inadequate number of the imported cartons, some cartons in the upper layers of the pallet were sourced from a domestic manufacturer. Unfortunately, these were very weak and suffered partial collapse. It is imperative to use a strong carton that will not collapse from the weight of the cartons above. The majority of mangoes exported to Europe by marine container are packed in 4-kg open-top cartons on slightly larger pallets than used for the S.B. Chaunsa trial shipment. These pallets typically container 252 cartons, with a 4-kg fruit net weight. There are 21 layers of cartons, with 12 cartons per layer.

Figure 4: Packing of mangoes in open-top cartons and firmly secured on pallet

The pallets were left in the blast chiller until the pulp temperature reached 12-13° C. This required between 4-5 hours, depending on the number of fruit loaded into the blast chiller. After cooling, the pallets were moved into the adjacent cold storage room, also

maintained at 12-13° C. The pallets remained inside the cold storage room for approximately 1 day, until loading into the marine container.

Marine Container Loading

The 20-foot marine container contained 12 pallets. E.U. phytosanitary regulations require all wooden pallets be fumigated in order to prevent the introduction of unwanted pests. There were 1,512 cartons in the marine container, for a total fruit weight of approximately 6 metric tons. The pallets were center-loaded into the marine container, with a small gap between the inner metal wall of the marine container and the outer wall of the pallet. Rectangular pieces of 10-cm thick Styrofoam were stuffed into the gap areas to prevent pallet shift during transit. Due to warm air influx into the marine container during loading, the fruit temperature rose several degrees. The loading dock door was not able to be sealed tightly, which allowed significant amounts of warm air to enter. Also, the physical process of loading the 12 pallets into the marine container was slow and cumbersome. The entire marine container loading process took 4 hours. After the pallets were loaded into the refrigerated marine container, the rear door was sealed and the container was transported to Port Qasim.

Figure 5 Adequately secured pallets inside marine container braced with Styrofoam against inner wall.

Inland Transport

The marine container departed the packinghouse of [redacted] at 11:30 a.m. on Thursday, July 21. [redacted] was the freight forwarder and [redacted] was the commercial exporter. The marine container was equipped with a Genset to maintain refrigeration during over-the-road transport. Upon arrival at the Maersk Lines container staging facility outside of Port Qasim, the container was plugged into the electrical power source to maintain refrigeration during the brief holding period. The container was then loaded onto the deck of the departing vessel, which left from Port Qasim on Saturday, July 23. The internal temperature of the container was set at 11.5° C.

Figure 6 Departure of the refrigerated 20-foot marine container used to transport mangoes from Mumtaz AgriFarms to the Netherlands.

Marine Container Transport

The marine container was put on the Maersk Lines feeder vessel destined to Salalah, Oman, arriving on Monday, July 25. The container was transferred onto a larger vessel Maersk Lines vessel which departed Wednesday evening, July 27. Due to an unexpected change in the sailing route, the vessel arrived in Rotterdam several days later than originally scheduled. The vessel arrived in the Port of Rotterdam late in the afternoon of Friday, August 12. Due to the weekend and limited work hours for most importers on Saturday and Sunday, the container was not able to be received at the Solfruit warehouse in Barendrecht until 8:00 a.m. on Monday, August 15. The pallets were unloaded from the marine container with a forklift and staged in the refrigeratated (10° C) receiving warehouse of Solfruit. The pallets were properly braced inside the marine container and little or no damage occurred to the cartons during transport.

The interval between fruit harvest and arrival at the warehouse of Solfruit was 26-27 days. This was an undesirably long period of time, due to re-routing of the vessel and a late Friday arrival at the Port of Rotterdam. This added 6 more days to the scheduled arrival time. Temperature data from the recorder place in the container indicated the internal temperature was 11.5° C during the entire voyage.

The following pictures show that proper pallet bracing inside the marine container allowed for easy unloading (of well-secured pallets staged at the Solfruit warehouse.

Figure 7: Proper pallet bracing inside the marine container, easy unloading and well-secured pallets staged at the Solfruit warehouse

Fruit Quality Evaluation Methodology

Randomly selected fruit from cartons throughout the load were selected for fruit quality analyses upon arrival of marine container at the Solfruit premises. Independent analyses of the fruit quality were made by the Solfruit quality control staff (Attachment 1) and the Firms technical specialists. The Solfruit quality control staff analyzed at least five randomly selected cartons from each pallet for various quality parameters.

The Firms specialists selected 9 different cartons of 9-count fruit (81 total fruit) from each of the different postharvest treatments for evaluation of postharvest decay and skin discoloration. A total of 9 randomly selected fruit from each of the different postharvest treatments were analyzed for internal pulp color, % sugar, and firmness. The following fruit quality parameters were measured:

-anthracnose decay (> 5 % of the fruit skin surface area)
- stem-end rot decay (> 5 % of the fruit skin surface area)
-skin discoloration/browning (> 5 % of the fruit skin surface area)
-°Brix (% sugar content) by refractometry
-pulp firmness by pressure testing of peeled fruit

Fruit Arrival Quality Condition

The S.B. Chaunsa fruit from both farms arrived in poor condition, primarily due to the high incidence and severity of anthracnose and stem-end rot decay. Approximately 40 % of the fruit had noticeable symptoms of one or both types of fungal decay. In addition, anthracnose and stem-end rot decay continued to increase during the 5-day ripening period after arrival. The over-riding quality characteristic of the fruit from both farms was the high amount of postharvest decay.

The high amount of postharvest decay can be attributed to a combination of high fungal inoculum concentration on the fruit at the time of harvest, plus the undesirably long period for fruit arrival. Refrigerated marine container transit times of more than 21 days will always be high risk shipments, with the likelihood of significant arrival quality issues. Use of low oxygen CA marine containers may extend the fruit market life an additional week.

Upon arrival, the skin color was mostly green, with noticeable discoloration and browning of many fruit. Approximately 25 % of the fruit exhibited some degree of skin discoloration. None of the S.B. Chaunsa fruit had ripened to a uniform full yellow color. Sapburn stains were observed on about 30 % of the fruit in the container. Most of the sapburn stained areas were infected with anthracnose.

Fruit flavor was excellent and characteristic of the S. B. Chaunsa cultivar. The fruit also arrived in firm condition, which was very desirable by the importer. The importer considered the fruit firmness to be acceptable for their retail supermarket clients. The firmness level was a significant improvement over the previous Sindhri shipment. This can be attributed to the slightly lower pulp temperature during transit for S.B. Chaunsa.

The importer gave a quality rating of 4 (poor) to the overall marine container load of fruit, on a scale of 1-5. This was primarily due to the prevalence of postharvest decay.

The green-skinned fruit did not ripen to a normal yellow color during the post-arrival period. Skin discoloration and browning continued to intensify in the post-arrival period. However, the pulp color of most of the S.B. Chaunsa fruit was a uniform yellow. Uneven “egg-yolking” of the flesh was observed in approximately 10 % of the fruit, but was minor in the degree of severity and not a significant quality defect.

The physical integrity of the load was good, with minimal carton collapse and pallet damage. The surface of the pallets contained enough boards to eliminate lower carton collapse. In addition, use of Styrofoam bracing material between the inner wall of the marine container and the pallets prevented load shifting during transit.

The high amount of postharvest decay on the S.B. Chaunsa fruit from both farms was a concern to the importer. However, the excellent taste, very high sweetness (average 24° Brix), and firm fruit were highly desirable characteristics. Internal pulp color was also a uniform yellow. The green skin color would not be an adverse fruit quality characteristic for marketing S.B. Chaunsa to the mainstream retail supermarkets. However, this would be a quality defect in marketing the fruit to Asian community consumers.

Consumer education, in-store fruit sampling, market promotion, and value-added packaging are all needed to expose the mainstream E.U. consumer to the excellent taste of S.B. Chaunsa mangoes. Representative illustrations of the S.B. Chaunsa arrival condition are shown below. Figures 17 to 21 show the external appearance of S.B. Chaunsa mangoes upon arrival in Netherlands, 26-27 days after harvest.

Figure 8: S.B. Chaunsa mangoes upon arrival in Netherlands, 26-27 days after harvest

Figures 22 and 23 show the internal appearance of S.B. Chaunsa mangoes upon arrival in Netherlands, 26-27 days after harvest.

Figure 9: internal appearance of S.B. Chaunsa mangoes upon arrival in Netherlands, 26-27 days after harvest.

Firmness

Considerable ripening of the S.B. Chaunsa mango fruit occurred following harvest and during transit. The pulp texture changed from very firm at harvest to firm upon arrival. The average penetrometer firmness of the green-skinned fruit upon arrival was 5.0 lbf (pounds-force) (2.3 kg-force) using a 16 mm tip. The 11.5° C transit temperature reduced the rate of ripening and allowed for a firm textured fruit upon arrival.

Sugar Content

The sugar content of the S.B Chaunsa mangoes increased from the average at harvest Brix of 6.5° (6.5 % sugar) to between 22.7°-27.6° for the green-skinned fruit upon arrival. The fruit were ready-to-eat upon arrival and the flavor was excellent.

Figure 10: Hand-held digital refractomer used to measure °Brix (% sugar) of mango fruit.

Experimental Postharvest Treatments

A number of different postharvest treatments were administered at the packinghouses in order to determine the optimal postharvest care treatment. Upon arrival in the Netherlands the fruit from the experimental cartons were analyzed for peel coloration, postharvest decay, overall fruit condition, sugar content (i.e. °Brix), and firmness. A total of 81 fruits from each treatment (9 cartons of 9-count size fruit) were selected for evaluation of postharvest decay and skin discolration. Nine fruit from each treatment were randomly selected for firmness and Brix measurements.

The fruit from all the posthavest treatments were manually de-sapped, followed by the following treatment conditions:

1) damp cloth cleaned (control)
2) hot water submergence at 52°C for 3 minutes
3) hot water submergence at 52°C for 5 minutes
4) hot water submergence at 52°C for 8 minutes
5) hot water submergence at 52°C for 5 minutes plus 500 ppm Nativo fungicide (trifloxystrobin and tebuconazole)
6) hot water submergence at 52°C for 5 minutes plus 500 ppm Amistar fungicide (azoxystrobin)
7) hot water submergence at 52°C for 5 minutes plus 500 ppm Tecto fungicide (thiabendazole)
8) hot water submergence at 52°C for 5 minutes plus Prime-Pro permaeable in-carton liner bag

There was considerable variability among the fruit sampled within a given treatment. The averaged fruit quality parameter characteristics for each treatment are shown in the table below.

Table 1: Fruit Arrival Quality of S.B. Chaunsa from Different Postharvest Treatments

Quality Parameter	Control (Lutfab)	Control (Mumtz)	Prime Pro Bag (Lutfab)	Prime Pro Bag (Mumtz)	Nativo (500 ppm)	Amistar (500 ppm)	Tecto (500 ppm)	Hot Water 3 min @52C	Hot Water 5 min @52C	Hot Water5 8 min @52C
Skin Color	LG	LG	LG	LG	LG	LG	LG	LG	LG	LG
Fruit Firmness (lbf)	6.5	3.7	3.4	2.4	3.9	5.5	5.4	7.3	6.1	5.4
Brix (% sugar)	22.3	22.9	19.8	22.2	24.1	23.4	23.8	23.5	22.5	23.0
Pulp Color	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Postharvest Diseases										
Anthracnose	62%	42%	7%	35%	9%	31%	31%	20%	21%	35%
Stem-end rot	11%	20%	12%	37%	0%	17%	21%	53%	40%	40%
Defects										
Skin Discoloration	22%	42%	14%	98%	11%	31%	20%	32%	20%	25%
Egg Yolking	15	15	15	15	15	15	15	15	15	15
Vivipary	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Shriveling/Moisture Loss	8%	8%	0%	0%	8%	8%	8%	8%	8%	8%
Physical Damage	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Organoleptic	E	E	E	E	E	E	E	E	E	E

Acceptability										
Hedonic Scale	9/10	9/10	9/10	9/10	9/10	9/10	9/10	9/10	9/10	9/10
Total Marketable Product	33%	33%	75%	20%	90%	60%	60%	25%	33 %	30%

Abbreviations: LG=light green; Y=yellow; E=excellent

In general, the hot water treatments reduced the severity of anthracnose, but not stem-end rot. The Prime-Pro in-carton bag liners eliminated weight loss during transit, but accentuated skin discoloration. The fungicide Nativo showed the greatest promise of all treatments. Submergence of the hot water treated fruit in 500 ppm Nativo (active ingredients trifloxystrobin and tebuconazole) significantly reduced the amount of anthracnose and eliminated stem-end rot. Further tests are needed to verify the excellent postharvest disease control properties of Nativo. This fungicide is registered for use in several other countries for decay control in mangoes. A product registration in Pakistan should be prioritized. The preliminary data obtained from this trial shipment using Nativo looks very promising. The use of Nativo may be shown to be critical for significant reduction in postharvest decay of Pakistani mangoes. If so, it may facilitate successful arrivals of S.B. Chaunsa mangoes by marine container to Europe and other distant export market destinations.

Constraints Impacting Fruit Arrival Quality

The main constraints to the successful arrival of the S.B. Chaunsa marine container shipment were postharvest decay, skin discoloration/browning, and sapburn. These constraints will have to be alleviated in order to provide the E.U. importers with the consistency and quality of fruit they require.

Postharvest Decay

Anthracnose, caused by strains of the fungus *Colletotrichum gloeosporioides*, and stem-end rot, caused by various fungi (including species of *Dothiorella*, *Lasiodiplodia*, *Phomopsis*, and *Cytosphaeria*) are the two most common postharvest mango diseases in Pakistan. They are the principal decay agents responsible for fruit deterioration in all mango cultivars. These fungal diseases are widespread throughout all growing regions and must be managed prior to harvest in order to be able to provide export market destinations with consistent supplies of high quality fruit. As trees become older and larger, the losses from these diseases typically increase. The incidence and severity of postharvest decay also intensifies as the harvest season progresses due to increasing humidity and eventual precipitation. Postharvest decay is generally less of a constraint in the early season exports of the Sindhri cultivar. The disease pressure is typically higher on S.B. Chaunsa, Fajri, and White Chaunsa cultivars, as precipitation increases later in the mango harvest season. The incidence and severity of postharvest decay will typically be higher in fruit from larger, older trees and on fruit harvested from unsprayed trees.

Figure 11: Fruit from excessively tall and inadequately pruned trees typically have high amounts of anthracnose and stem-end rot contamination

An integrated program involving pre-and postharvest control measures is required to minimize losses. Spores of these fungal pathogens infect the fruit while developing on the tree, but remain in a latent or dormant state until after harvest. The severity of infection is accentuated by pre-harvest rainfall. Symptoms of these diseases typically become apparent only after harvest and during fruit ripening. In most cases the producer is oblivious to these diseases since the symptoms are expressed after the fruit has left the farm. Heavy market losses occur every year due to these diseases.

In order to minimize the incidence and severity of anthracnose and stem-end rot, it is imperative growers use proper pre-harvest cultural practices. This must include annual tree pruning to maximize air movement within the tree, proper orchard sanitation, and multiple applications of pre-harvest crop protectant fungicides beginning at flowering and continuing until harvest. The fungicides must be applied during all stages of fruit development in order to prevent spore germination and mycelial growth. Without the adoption of these practices, it will not be possible to control postharvest fruit decay and deliver consistent supplies of high quality mango fruit to the export market.

Figure 12: Smaller, well-pruned mango trees are preferred to minimize disease pressure

Various fungicides are effective in controlling anthracnose, stem-end rot, and other mango diseases. These pre-harvest applied fungicides include copper oxychloride,

mancozeb, captan, chlorothalonil, iprodione, prochloraz, thiabendazole, propiconizole, azoxystrobin, trifloxystrobin, and tebuconazole. Growers may have to make 10 to 20 pre-harvest fungicide treatment applications from flowering through the entire growing season (weekly to bi-weekly) for the degree of postharvest decay control required by the export market. Poor disease control may be related to inadequate spray coverage, inappropriate timing, or high amounts of rainfall during the growing season.

Skin Discoloration/Browning

Skin darkening/browning is a quality defect that detracts from the appearance of the fruit. Skin discoloration may occur due to chilling injury, heat stress, or other stress-related factors. Chilling injury in mature green stage fruit typically requires exposure temperatures ≤ 11° C. However, it is possible that S.B. Chaunsa fruit may be highly susceptible to chilling injury and some skin discoloration can occur at 12° C if the exposure time is at least several weeks. Additional time-temperature studies are needed to determine the exact threshold conditions responsible for inducing skin discoloration in each of the Pakistani mango varieties.

Sapburn

The majority of the mango fruit harvested at both farms was manually de-sapped and the severed stem was left to dry in the open air on de-sapping racks. Nevertheless, a significant amount of sapburn on the skin of the fruit was noticed upon arrival in the Netherlands. This may be attributed to inadequate de-sapping time in the field and/or improper orientation of the fruit on the de-sapping racks. In some fruit, it was observed that the cut stem was not properly oriented in a vertical upside-down position, which allowed for some sap to come in contact with the peel.

Closer supervision of the field workers and strict adherence to the vertical upside-down orientation of the fruit are necessary while cutting the stem and de-sapping the fruit. Longer de-sapping times in the field are needed to ensure all of the latex has stopped exuding from the severed stem prior to moving the fruit to the packinghouse. Also, a slightly longer stem stub will help to reduce the amount of sap flow.

Figure 13: Improper or incomplete de-sapping results in latex exudation from the cut stem onto the fruit

4. CONCLUSION

The S.B. Chaunsa trial shipment fruit arrived in the Netherlands in poor condition, primarily due to the high incidence and severity of anthracnose and stem-end rot decay. This can be attributed to a combination of high fungal inoculum concentration on the fruit at the time of harvest, plus the undesirably long arrival time. Refrigerated marine container transit times of more than 21 days will always be high risk shipments, with the likelihood of significant arrival quality issues.

The high amount of postharvest decay on the S.B. Chaunsa fruit from both farms was a concern to the importer. However, the excellent taste, very high sweetness (average 24° Brix), and firm fruit were highly desirable characteristics. Internal pulp color was also a uniform yellow. The green skin color would not be an adverse fruit quality characteristic for marketing S.B. Chaunsa to the mainstream retail supermarkets. However, this would be a quality defect in marketing the fruit to Asian community consumers.

Solfruit remains very interested in receiving significant volumes of Pakistani mangoes next season. They are interested in receiving up to 30-40 marine containers (40-foot length) during the late-May to September harvest season. This represents a very significant market opportunity for a commercial exporter and combination of mango producers next season.

Preliminary data from the different experimental treatments indicated at least one of the postharvest fungicides can provide excellent control of anthracnose and stem-end rot. The use of this fungicide may be shown to be essential for the significant reduction of postharvest decay in Pakistani mangoes. If so, it may facilitate successful arrivals of S.B. Chaunsa mangoes by marine container to Europe and other distant export market destinations.

5. Appendices

The fruit quality report made by Solfruit upon arrival of the marine container is shown below. Solfruit Arrival Quality Report (S.B. Chaunsa

Solfruit international

FRUIT CONDITION REPORT – RECEIVED BY SOLFRUIT INTERNATIONAL BV

CONSIGNMENT INFORMATION

Date of arrive:	15-07-2011	**Reference Solfruit:**	PTN-10-002927
Supplier:	Firms Project	**Vessel:**	MAERSK DAUPHIN
Container:	PONU 293200-4	**Ryan Recorder:**	1614680
Product:	Mangoes Pakistan	**Variety:**	CHAUNSA
Brand(s):	Various	**Category:**	Cat I
Amount of pallets:	12 pallets	**Amount of cartons:**	About 1512 boxes
Amount of inspected pallets:	12 pallets	**Amount of inspected cartons:**	70 boxes

TEMPERATURE & PACKING INFORMATION

Pulp Temperature:	12.9-14.0-13.8-11.9	**Packaging**	Open top cartons
Ryan Temperature:	11 degrees celcius	**Palletizing**	Bad (all the pallets was slanting, bottem layers damaged, because it was too many space between the pallet and the doors. We don't found any label on the boxes with the sizes. The boxes in the middle of the pallets, are without any label with variety – sizes- produce of ..... It's important.
Transport claim:	Not	**Gross Weight per carton**	3,70 kg
Size:	9er & 12er	**Tarra**	360 gram
Traceability Code:		**Nett Weight per carton**	Average is 3,50kg underweight
Farm:			

PRODUCT OBSERVATION

Texture consistency	Firm Sensitive to soft mix
Ripeness & Maturity	Turning to Ripe mix
Brix Readings	24.9% -24.6% -22.5% average 24%
Eating Quality	Turning to Good (ready to eat)
External Colour	Greenish to greenish yellow undertone
Internal Colour	Yellow
Internal Defects	Not found during inspection
External Defects	• Resin skin damage size 9 = 33% • Resin skin damage Size 12= 34% • Stem end rot and anthracnose Size 9 = 44% • Stem end rot and anthracnose Size 12= 41% • Mould on the stem end slight 15% • Scab 5% • Bruising slight 12% • Brown skin 20%

Decay	Yes, Stem –end rot and anthracnose 85%

CONCLUSIONS

Quality Score (from 1-5)	4 (because the ripeness – skin defects and decay)
Necessary Actions	The consignment has to be claim by the supplier for the decay and mix ripeness The mangoes has to be sold on local marked commercial problems will be expected Pictures included.

1= Excellent
2= Good
3= Regular (part of the consignment is showing problems, quality report has to be considered as a (partial) claim)
4= Poor (the entire consignment is showing serious problems, quality report has to be considered as a claim)
5= Total Loss (the consignment has to be destroyed, quality report has to be considered as a claim)

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