भारतीय पैंकेजिंग संस्थान
Indian Institute of Packaging
An autonomous body under the Ministry of Commerce & Industry, Govt. of India

REPORT ON

DEVELOPMENT OF SUITABLE PACKAGE & FORMULATION OF PACKAGING SPECIFICATION FOR FRESH KIWI FROM NORTH EASTREN STATES

FOR

AGRICULTRUAL AND PROCESSED FOOD PRODUCTS EXPORT DEVELOPMENT AUTHORITY

STUDY CARRIED OUT BY

INDIAN INSTITUTE OF PACKAGING

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1. EXECUTIVE SUMMARY

1. EXECUTIVE SUMMARY

Kiwi fruit or Chinese gooseberry is an edible berry with a fibrous, dull greenish-brown skin and bright green or golden flesh with rows of tiny, black, edible seeds which are found in the hills of Arunachal Pradesh.

Arunachal Pradesh is India's largest producer of Kiwis, which annually produces an average of 4,720.5 MT of kiwi. The Arunachal kiwi is an organic fruit which is traditionally and naturally cultivated in the hills and valleys of the state especially in the Ziro region. It is the future crop of the state which could provide sustenance to the economy of the rural masses and the state. It is fast emerging as an important fruit in the northeastern states like Nagaland, Sikkim, Meghalaya and Mizoram. Hence, there is tremendous potential for creating a robust and vibrant kiwi based economy for Arunachal Pradesh.

Kiwifruit is well known for its flavour and vitamin C content. It is a climacteric fruit and is very sensitive to ethylene. Botanically, kiwifruit is a berry with various locules filled with numerous small and soft black seeds. Its flesh is divided into three regions: the outer pericarp, the inner pericarp with seeds, and the columella (core).

Considering the nutritional value as well as market potential, it is felt that this particular fruit could be explored for the export market. However, for export market, the packaging plays a crucial role in terms of providing the protection, preservation as well as presentation. Moreover, the fresh Kiwi fruit, being perishable in nature, there is an urgent need to develop a suitable package by considering all the scientific aspects of packaging material. Moreover, the unit package need to be developed in such a manner which would be more consumer friendly and act as self-selling packs. In fact, today, in the global scenario governed by WTO, it is imperative for our country to upgrade the packaging standards of fresh fruits and vegetables at par international level so that those fruits in packaged condition can be considered for export market.

Under this background, Agricultural and Processed Food Products Export Development Authority (APEDA) an autonomous organization under the Department of Commerce, Ministry of Commerce & Industry, Govt. of India has requested the Indian Institute of Packaging to undertake a R&D project on the development of suitable package design and also for the estimation of shelf life of fresh kiwi fruit grown in the state of Arunachal Pradesh. Based on the laboratory testing for the quality assessment of packaging material as well as packages and the shelf life studies, the Institute is also required to formulate the suitable packaging specification for unit package as well as transport packages.

Based on this requirement, the Institute has carried out a detailed study about the selection of suitable packaging materials for the development of unit package of kiwi fruit containing of 6 to 12 nos. Accordingly, the following options of packaging materials were selected.

a) Micro – perforated plastic pouch
b) Plastic punnet with lid
c) Expanded polystyrene (EPS/Moulded pulp tray with stretch / cling film)
d) Extruded plastic tubular net bag (Net Lon bag)

The products packed in above mentioned different options were exposed to the low temperature (0°C to 4°C) in order to enhance the shelf life of the perishable product. At the same time, the packaged products of all options were also exposed to the ambient condition i.e., 27°C±1°C and 65% RH±2%RH in order to have a comparative study about the quality of fruits during storage. The exposed samples were withdrawn at an interval of 24 hrs from the climatic chamber of having 0°C to 4°C as well as from the climatic chamber ambient condition i.e., 27°C±1°C and 65% RH±2%RH . The exposed samples were then tested in the laboratory for important parameters like physiological loss in weight, change in total soluble solids (TSS) in ° Bricks and also about the observation on the physical changes of the fruit like shrinkage, welting, rotting or

the appearance of fungus growth etc., The study was carried out till the product was found to be not acceptable based on the loss in weight as well as the physical observation of the fruit.

Based on the study, it is found that the product packed in two different options of unit package have shown the maximum shelf life of fruits of 44 days and 16 days when the products were exposed to 0-4°C and 27± /-2°C respectively. The details are given below:

S.No.	Material	Kiwis Exposed to 0-4°C	Kiwis Exposed to 27± / -2°C
1	Micro-perforated plastic pouch	44	16
2	EPS/Moulded pulp tray with stretch / cling film	44	16

In addition, the Institute has also carried out the study for the development of bulk package of having capacity of 5 Kg where either the corrugated fibre board boxes of four different styles i.e., regular slotted container, telescopic box design (two pieces), Lid and Tray box were considered or the moulded expanded polystyrene box is used. As an alternative, bulk package of having 4 Kg capacity is also developed by using corrugated fibre board boxes where two layers of moulded pulp tray of having 10 nos. of Kiwifruits are placed.

Besides, the R&D project report has also highlighted about the number of boxes to be placed either on IATA or Euro Pallets and its arrangements on the pallet while different types of unit package were considered. After having the detailed study, it is observed that the unit package (consumer pack) made of micro perforated bags with 6 nos. and 12 nos. of Kiwifruits have shown the maximum area of utilization i.e, 85.18% and 85.88% while 42 no. of boxes and 4 no. of boxes are placed on IATA-B or Euro-B type pallet. In the same line, the unit package (consumer pack) made of plastic punnet placed in one piece tuck – in type box with 6 nos. and 12 nos. of Kiwifruits have shown the maximum area of utilization i.e, 93.45% while 30 no. of

boxes are placed on IATA-A pallet. It is also observed that EPS moulded pulp tray with stretch / cling film (6 nos. or 12 nos.) while placed on IATA-A type pallet, the maximum number of 20 boxes can be placed. The same trend is also observed in other options also. In short, the IATA-A type pallet which is having larger dimension can always take more number of boxes and the same can be recommended for the palletisation for export market.

2. OBJECTIVE

2.OBJECTIVE

The following objectives are identified :

1. To study the existing packaging system of kiwi .

2. To study the present practice of distribution network from the production centre.

3. To assess the quality parameters of the fresh fruit and its packaging materials

4. To undertake the shelf-life study of kiwi in packaged condition by using different type of packaging materials and systems at low temperature as well as ambient conditions.

5. To analyse the packaging materials and formulate the technical specifications of the recommended packaging materials.

3.METHODOLOGY

3.METHODOLOGY:

1. To study the currently adopted packaging systems for kiwi by undertaking visits to 1 or 2 processors/packers.

2. To analyse the presently used packaging materials/systems by the processors/ packers.

3. To develop consumer packages for kiwi (6 nos. & 12 nos) by undertaking shelf - life/storage studies or compatibility studies. The consumer packs to be considered would be :
    - Micro-perforated plastic pouch
    - Plastic punnet with lid
    - EPS / Moulded pulp tray with Stretch /Cling film
    - Extruded Plastic Tubular net bag (Netlon Bag)

4. To develop transport pack for consumer pack.

5. To develop direct bulk packages for kiwi (2 kgs & 5 kgs). The bulk packs to be considered would be :
    - Corrugated Fibreboard (CFB) Box
    - Moulded Expanded Polystyrene (EPS) Box

6.. To evaluate the basic physical/ physico- chemical properties of all the packaging materials such as:
    - Thickness
    - Water Vapour Transmission Rate (WVTR)
    - Oxygen Transmission Rate (OTR)
    - Migration Studies

7. To conduct shelf-life studies in the selected packaging materials. The shelf life studies would be conducted by exposing the filled packs to $0 - 4^0$ C and standard conditions of 27 +/-2 ^{0}C and 65 +/- 2% RH. The samples would be withdrawn at regular intervals for assessment of keeping quality of the product with respect to the following parameters:
    - Loss in weight
    - Total Soluble Solids (TSS) in °Brix
    - Change in taste & aroma (organoleptic evaluation)
    - Texture
    - Microbial growth – visual observation

8. In addition to assessing the quality of the product, the materials used for packaging of these products would also be assessed for compatibility and for any changes such as softening, cracking, delamination.

9. To tabulate the results and analyse the same for determination of shelf-life of the product in the selected packaging materials at standard conditions.

10. To draw up specification details for the recommended consumer packs.

11. To develop transport pack for consumer packs of products selected for the study.

12. To draw up specification details of the recommended transport packs.

13. To develop direct bulk pack for packaging of kiwi .

14. To draw up specification details for the recommended direct bulk packs.

15. To submit a detailed report on areas 1 to 14 above.

4.PRESENT PACKAGING SYSTEM

4.PRESENT PACKAGING SYSTEM

At present , in India there is neither any packaging specification nor any standard package for kiwi fruits. Cardboard boxes of 3-4 kg. capacity are generally used for packing.. The fresh fruits are handled manually for multiple times till it reaches the consumer.

Road transport by trucks/lorries is the most popular mode of transport due to easy approach from orchards to the market. The growers usually dispose off their produce at the farm gate to the middlemen. Majority of the cultivators sell their crop either through trade agents at village level or commission agents at the market.

It is observed that reused CFB boxes are used to pack kiwis. The boxes are without any ventilation holes, as result there is no circulation of air and the fresh produce gets spoiled. It was also observed that the boxes are stapled, which may burse the fresh produce.

Considering the existing practice of handling, storage and transportation of bulk packages for kiwi it is observed that the quality of the CFB boxes are insufficient to withstand in terms of mechanical, chemical and biological hazards being created during the operation and hence, it is required to formulate the optimum packaging standards for fresh kiwi from North Eastern states.

5.PACKAGING MATERIALS SELECTED FOR CONDUCTING SHELF-LIFE STUDIES

5. PACKAGING MATERIALS SELECTED FOR SHELF-LIFE STUDIES.

In order to develop the consumer / bulk packages for kiwis, the following International standards related to packaging and transportation of fresh fruits and vegetables were referred.

1. Manual on the packaging of fresh fruits and vegetables by International Trade Centre, UNCTAD/GATT (1988 edition).
2. Guide to food transport-fruits and vegetables. (Mercentla Publication 1989)

This manual helped us to understand about the packaging trends in the International market. Accordingly, it is found that the following packaging materials are normally used as packages for the packaging of fresh fruits and vegetables for export. While selecting the packaging materials and packages, new type of packaging materials which would have the ability to add value to the product and also be eco- friendly and economical.
Following packaging materials were selected for shelf-life studies:

a) Micro-perforated plastic pouch
b) Plastic punnet with lid
c) EPS / Moulded pulp tray with Stretch /Cling film
d) Extruded Plastic Tubular net bag (Netlon Bag)
e) Corrugated fibre board boxes

Following factors were considered while selecting the packaging for kiwis:

i) Net weight of the pack
ii) Nature of the fruits/vegetables
iii) Stacking during transportation
iv) Mode of transportation

6.DEVELOPMENT OF CONSUMER PACKS

6. DEVELOPMENT OF CONSUMER PACKS

Discussions with the exporters reveal that so far there has been negligible exports of kiwis in consumer packs from India, and therefore no consumer packaging system for exports exists. The alternate consumer packs considered are:

a) Micro-perforated Plastic Pouch

The micro-perforated pouch is a flexible three side sealed pillow pouch with micro-perforated holes. The pouch material is Low Density Polyethylene (LDPE) or Polypropylene (PP) which offers good visibility, strength, permeability and printability. The micro- perforated holes circulate air in and around the pack and help in prolonging the shelf-life of the fresh produce.

b) Plastic Punnet with Lid

Punnets are semi rigid clean, bright plastic containers which offer product visibility. Holes provide ventilation and circulation of air thereby retaining the freshness of the produce. They are light weight, stackable and recyclable made of PET. The punnets are also provided with a locking system so that the lid firmly sits on the tray and there are no chances of it opening out.

c) EPS / Moulded pulp tray

The kiwis are placed on a moulded expanded polystyrene tray and the tray is wrapped with a cling film. The trays are clean, neat in appearance and light in weight. They give a cushioning effect to the products packed inside. The trays can be easily moulded in any size and shape. The materials used can be easily cleaned, re-used and are also recyclable. The moulded pulp tray is made from recycled paper pulp and a starch binder and is biodegradable and eco-friendly. The kiwis are placed in individual cavities, so that abrasion and bruising during transport is avoided and wrapped with a cling film. The tray also provides a

cushioning effect to the produce. Pulp containers are available in a large variety of shapes and sizes and are relatively inexpensive in standard sizes.

d) Extruded Plastic Tubular net bag (Netlon Bag)

Woven net bags are extruded from Nylon and closed by knotting one end. These bags have the feature to stretch to accommodate all sizes and shapes of produce. They are available in roll form or in pre-cut lengths and stretch width is 200 mm – 400 mm.

e) Stretch Film/Cling Film

The stretch film is a transparent film with the property of clinging to the packed product when stretch wrapped. It can be used without application of heat. The film is semi-permeable and allows exchange of gases for respiration of the produce.

The dimensional details of the consumer packs are given in Annexure- X

7.SHELF-LIFE STUDIES

7. SHELF-LIFE STUDIES

25 kgs. of kiwis were procured from Arunachal Pradesh by air cargo. Shelf-life studies were carried out in the laboratory for development of packaging systems. The kiwis were actually packed in alternate packs considered as given earlier in the report.

The packages were exposed to 0 – 4^0 C and 27+/- 1°C. The kiwis were assessed for their freshness by visual observations and by checking loss in weight/moisture content.

The samples were withdrawn at regular intervals for assessment of keeping quality of the product with respect to the following parameters:

- Loss in weight
- Total Soluble Solids (TSS) in °Brix
- Change in taste & aroma (organoleptic evaluation)
- Texture
- Microbial growth – visual observation

The studies were discontinued after the kiwis showed spoilage. The observations are given in Annexure I to Annexure VIII.

7.1 INTERPRETATION OF TEST RESULTS FOR AND CONCLUSION OF SHELF – LIFE STUDIES

From Annexure I it is observed that the physiological loss in weight (%) of kiwis packed in micro-perforated pouches stored at 27+/- 1°C was 0.39 % on day1 which increased to 5.15% after 18 days. Similarly total soluble solids (TSS) on day 1 was 13 °Brix which increased to 16.13 °Brix after 18 days. This resulted in fungus growth and rotting.

From Annexure II it is observed that the physiological loss in weight (%) of kiwis packed in plastic punnet with lid stored at 27+/- 1°C was 0.28 % on day1 which increased to 3.75% after 18 days. Similarly total soluble solids (TSS) on day 1 was 13 °Brix which increased to 15.74 °Brix after 18 days. This resulted in fungus growth and rotting.

From Annexure III it is observed that the physiological loss in weight (%) of kiwis packed in EPS / moulded pulp tray with stretch /cling film stored at 27+/- 1°C was 1.85 % on day1 which increased to 6.19 % after 12 days. Similarly total soluble solids (TSS) on day 1 was 13 °Brix which increased to 16.95 °Brix after 12 days. This resulted in watery exudation & softening of kiwis.

From Annexure IV it is observed that the physiological loss in weight (%) of kiwis packed in extruded plastic tubular net bag (Netlon Bag) stored at 27+/- 1°C was 2.48 % on day1 which increased to 8.21 % after 12 days. Similarly total soluble solids (TSS) on day 1 was 13 °Brix which increased to 16.58 °Brix after 12 days. This resulted in watery exudation & softening of kiwis.

From Annexure V it is observed that the physiological loss in weight (%) of kiwis packed in micro-perforated pouches stored at 0 - 4^0C was 0 % on day1 which increased to 0.8 % after 46 days. Similarly total soluble solids (TSS) on day 1 was 14.76 °Brix which increased to 15.87 °Brix after 46 days. This resulted in softening of kiwis.

From Annexure VI it is observed that the physiological loss in weight (%) of kiwis packed in plastic punnet with lid stored at 0 - 4^0C was 0 % on day1 which increased to 3.14 % after 46 days. Similarly total soluble solids (TSS) on day 1 was 14.65 °Brix which increased to 15.80 °Brix after 46 days. This resulted in softening of kiwis.

From Annexure VII it is observed that the physiological loss in weight (%) of kiwis packed in EPS / moulded pulp tray with stretch /cling film stored at 0 - 4^0C was 0 % on day1 which increased to 0.2 % after 46 days. Similarly total soluble solids (TSS) on day 1 was 15.10 °Brix which increased to 15.80 °Brix after 46 days. This resulted in softening of kiwis.

From Annexure VIII it is observed that the physiological loss in weight (%) of kiwis packed in extruded plastic tubular net bag (Netlon Bag) stored at 0 - 4^0C was 0 % on day1 which increased to 3.21 % after 46 days. Similarly total soluble solids (TSS) on day 1 was 14.75 °Brix which increased to 16.45 °Brix after 46 days. This resulted in softening of kiwis.

The shelf - life of kiwis packed in different packaging materials is given in Annexure IX.

Based on the test results obtained from shelf-life studies, it is clear that the following materials can be recommended for primary packaging of kiwis without having much affect on its physico-chemical properties :

1) EPS / moulded pulp tray with stretch /cling film
2) Micro-perforated pouches

8.DEVELOPMENT OF TRANSPORT PACK FOR CONSUMER PACKS

8. DEVELOPMENT OF TRANSPORT PACK FOR CONSUMER PACKS.

For the transportation of developed consumer packs, outer boxes have been developed to hold a suitable number of consumer packs.

The transport boxes are developed from corrugated fibre board as per the international practice, taking into consideration the following factors:

- Nature of the produce
- Net weight of contents
- Stacking during transportation
- Mode of transportation
- Modularity with Euro pallets.

The various alternates considered are:

a) Micro-perforated Plastic Pouch

The box styles considered are RSC (0201), Telescopic (0306) and (0312). 6 consumer packs of 250 gms. capacity (6 nos. of kiwi) and 6 consumer packs of 500 gms. capacity (12 nos. of kiwi) are placed in 2 x 3 pattern. 2 layers separated by separator plate. Slotted partitions of corrugated fibre board are placed inside the box and individual pouch is placed in each slot

b)Plastic Punnet with Lid

8 plastic punnets of 250 gms. capacity (6 nos. of kiwis) and 8 punnets of 500 capacity (12 nos. of kiwis) are packed in one layer inside a one-piece, tuck – in – type box in 2 x 4 manner.

c) EPS Tray Stretch Wrapped

8 trays of 250 gms. capacity (6 nos. of kiwis) and 8 trays of 500 capacity (12 nos. of kiwi) are packed in one layer inside a one-piece, tuck – in – type box in 2 x 4 manner.

d) Extruded Plastic Tubular net bag (Netlon Bag)

The box styles considered are RSC (0201), Telescopic (0306) and (0312). 6 consumer packs of 250 gms. capacity (6 nos. of kiwi) and 6 consumer packs of 500 gms. capacity (12 nos. of kiwi) are placed in 2 x 3 pattern. 2 layers separated by separator plate. Slotted partitions of corrugated fibre board are placed inside the box and individual net bag is placed in each slot.

8.1 CLOSURE AND REINFORCEMENT OF TRANSPORT PACKS

The RSC (0201) style boxes are closed by folding the top flaps and by application of pressure sensitive tape. The telescopic boxes are closed by placing the lid. For reinforcement, the boxes are provided with two heat sealable synthetic straps.

The dimensional details of the transport packs are given in Annexure- XI.

The placement of consumer packs in transport pack are given in Annexure-XII.

9.DEVELOPMENT OF DIRECT BULK PACKS

9.DEVELOPMENT OF DIRECT BULK PACK

The following packaging materials were considered for bulk packaging of kiwis for export.

- Corrugated Fibre Board boxes
- Moulded Expanded Polystyrene Box

9.1 CORRUGATED FIBRE BOARD BOXES

Considering the international practice being adopted in the overseas market, the bulk packages are developed by considering the following important factors :

- Net weight of the each package
- Nature of fruits and vegetables
- Stack height during storage
- Stacking pattern during transportation
- Handling system
- Mode of transportation

While developing the bulk packages, it is observed that the following four designs of corrugated fibre board boxes are very popular in the international market.

S.No.	Style of Box	International Code
1	Regular slotted containers	0201
2	Telescopic box (2pcs.)	0300
3	Lid and tray box	0306
4	Lid and tray box	0312

The different box styles considered for packaging of kiwis are:

- RSC (0201)
- Telescopic (0306)
- Telescopic (0312)

The above said designs of the corrugated boxes are considered where glued joints are recommended. In general, the telescopic style of boxes offer good compression strength. The boxes are erected by folding the bottom flaps and boxes are closed by means of pressure sensitive plastic tapes.

The RSC boxes are to be closed by folding the top flaps and by application of pressure sensitive tape. The telescopic boxes are closed by placing the lid on top. For reinforcement, the boxes are provided with two heat sealable synthetic straps.
These boxes protect the produce much better against hazards encountered in transit and in transfers from and to the truck because of its smooth non-abrasive surface . The CFB boxes have good cushioning characteristics causing minimum bruising / damage to the fresh produce.

Moulded pulp trays with cavities are developed to hold individual kiwi. Depending upon the size of the kiwi, moulded trays are made to suit each size and therefore the number of kiwi per tray may vary. Each box is meant to hold about 4 Kgs of kiwis. 2 layers of trays are packed per box.

The recommended dimensions of bulk packages is given in Annexure – XIII.

9.2 CLOSURE AND REINFORCEMENT

The Corrugated Fibre Board boxes are to be closed by folding the top flaps and by application of pressure sensitive tape. The telescopic boxes are closed by placing the lid on top. For reinforcement, the boxes are to be provided with two heat sealable synthetic straps.

9.3 MOULDED EXPANDED POLYSTYRENE BOX

Moulded expanded polystyrene box has also been considered for packaging of kiwis. The recommended dimensions for EPS boxes are given in Annexure XIII.

10. PALLETISATION DETAILS

10.PALLETISATION DETAILS

Most of the fruits and vegetables are transported by air. The packages are stored or transported as a pallet load. To maximize savings in distribution costs, pallet loads should be established as soon as possible in the distribution chain and remain unbroken as long as possible.

For international trade the ISO has specified two standard dimensions as the primary handling unit size, these are:

a) 1200 x 1000 mm

b) 1200 x 800 mm

In addition to above IATA pallet sizes were also considered. These are:

a) IATA A 3070 mm x 2130 mm

b) IATA B 3070 mm x 2340 mm

The above pallet sizes are used for distribution of fresh fruits and vegetables within Europe as well as for transportation of produce arriving unpalletised from European seaports and airports to its European destination.

The developed transport pack for consumer packs and direct bulk packs when placed on a pallet have dimensions modular/suitable to the pallet i.e. the boxes utilize maximum space to give freight advantage.

Annexure XIV gives the palletisation details for the developed transport pack for consumer packs and direct bulk packs.

11. TRANSPORT-WORTHINESS TESTS

11. TRANSPORT-WORTHINESS TESTS

For transport-worthiness trials, prototype packs were developed to hold 6 nos. and 12 nos. of kiwis as well as direct bulk pack. Prototypes 1, 2, 3 and 4 have been developed to hold 6 nos. of kiwis and prototypes 5, 6, 7 and 8 to hold 12 nos. of kiwis. Prototype 9 has been developed to hold 5 kgs of kiwis directly in the box. Prototype 10 has been developed to hold 5 kgs of kiwis placed individually in moulded pulp trays with cavities . prototype 11 has been developed to hold 5 kgs of kiwis in expanded polystyrene box.

1. PROTOTYPE 1

This prototype consists of one piece tuck in type CFB Box in which 6 nos. of kiwis packed in plastic punnets are placed in 4 x 2 manner. Ventilation is provided by means of holes of diameter 20 mm. Total 10 nos. of holes, 3 each at front and rear face of the box, 2 each at both ends of the box and two cuts one at each end for manually lifting the box were provided.

2. PROTOTYPE 2

This prototype consists of one piece tuck in type CFB Box in which 6 nos. of kiwis packed in EPS/ moulded pulp trays stretch wrapped are placed in 4 x 2 manner. Ventilation is provided by means of holes of diameter 20 mm. Total 10 nos. of holes, 3 each at front and rear face of the box, 2 each at both ends of the box and two cuts one at each end for manually lifting the box were provided.

3. PROTOTYPE 3

This prototype consists of RSC style corrugated fibre board box in which 6 nos. of kiwis in micro-perforated pouches are placed in 3 x 2 manner. 2 layers separated by separator plate Ventilation is provided by means of holes of diameter 20 mm. Total 16 nos. of holes, 3 each at two sides each of the box. 1 each at two ends each and 4 each on top and bottom.

4. PROTOTYPE 4

This prototype consists of RSC style corrugated fibre board box in which 6 nos. of kiwis packed in extruded plastic tubular net bag (Netlon Bag) are placed in 3 x 2 manner. 2 layers separated by separator plate Ventilation is provided by means of holes of diameter 20 mm. Total 16 nos. of holes, 3 each at two sides each of the box. 1 each at two ends each and 4 each on top and bottom.

5. PROTOTYPE 5

This prototype consists of one piece tuck in type CFB Box in which 12 nos. of kiwis packed in plastic punnets are placed in 4 x 2 manner. Ventilation is provided by means of holes of diameter 20 mm. Total 10 nos. of holes, 3 each at front and rear face of the box, 2 each at both ends of the box and two cuts one at each end for manually lifting the box were provided.

6. PROTOTYPE 6

This prototype consists of one piece tuck in type CFB Box in which 12 nos. of kiwis packed in EPS/ moulded pulp trays stretch wrapped are placed in 4 x 2 manner. Ventilation is provided by means of holes of diameter 20 mm. Total 10 nos. of holes, 3 each at front and rear face of the box, 2 each at both ends of the box and two cuts one at each end for manually lifting the box were provided.

7. PROTOTYPE 7

This prototype consists of RSC style corrugated fibre board box in which 12 nos. of kiwis in micro-perforated pouches are placed in 3 x 2 manner. Ventilation is provided by means of holes of diameter 20 mm. Total 16 nos. of holes, 3 each at two sides each of the box. 1 each at two ends each and 4 each on top and bottom.

8. PROTOTYPE 8

This prototype consists of RSC style corrugated fibre board box in which 12 nos. of kiwis packed in extruded plastic tubular net bag (Netlon Bag) are placed in 3 x 2 manner. Ventilation is provided by means of holes of diameter 20 mm. Total 16 nos. of holes, 3 each at two sides each of the box. 1 each at two ends each and 4 each on top and bottom.

9. PROTOTYPE 9

This prototype consists of RSC style corrugated fibre board box in which the kiwis are placed directly in the box. Ventilation is provided by means of holes of diameter 20 mm. Total 16 nos. of holes, 3 each at two sides each of the box. 1 each at two ends each and 4 each on top and bottom are provided.

10. PROTOTYPE 10

This prototype consists of RSC style corrugated fibre board box in which the kiwis are individually placed in moulded pulp trays. 2 layers separated by separator plate Ventilation is provided by means of holes of diameter 20 mm. Total 16 nos. of holes, 3 each at two sides each of the box. 1 each at two ends each and 4 each on top and bottom are provided.

11. PROTOTYPE 11

This prototype consists of moulded expanded polystyrene box having ventilation holes.

11.1EVALUATION OF PROTOTYPE PACKAGES FOR TRANSPORT-WORTHINESS TRIALS

All the prototype packages were filled with kiwis and closed with BOPP pressure sensitive tape in "C" manner, and further reinforced with 2 nos. of 12 mm wide plastic straps along the girth. Considering these packages are to be used for export of kiwis, transport worthiness tests such as vibration test, was carried out on the prototype samples. The results obtained are given in Annexure XV.

11.2 INTERPRETATION OF RESULTS & CONCLUSION OF TRANSPORT-WORTHINESS TRIALS

From Annexure XV it is observed that no damage was reported to the CFB boxes as well as to the kiwis. It can thus be concluded that the prototype packs developed (Prototypes 1 to 11) have provided adequate protection to the kiwis from mechanical hazards encountered during the distribution and transportation.

12. RECOMMENDED PACKAGING SYSTEM

12. RECOMMENDED PACKAGING SYSTEM

Based on the storage trials the recommended packaging system for consumer packs is as follows :

- Micro-perforated Plastic Pouch
- EPS tray stretch wrapped

Based on the transport worthiness trials the recommended packaging system transport pack for consumer packs is one piece tuck in type corrugated fibre board box having ventilation provided by means of holes of 20 mm diameter. Total 16 nos. of holes, 6 each at front and rear face of the box, 2 each at both ends of the box and two cuts one at each end for manually lifting the box. The kiwis are placed in micro-perforated pouches / EPS tray stretch wrapped and then kept in the CFB boxes. In case of micro-perforated pouches slotted partitions of corrugated fibre board are placed inside the box and the micro-perforated pouches are placed in each slot. Individual layers are separated by corrugated fibre board plates. Each box is meant to hold about 5kg. of kiwis.

The recommended packaging system for direct bulk pack is a R.S.C /Telescopic / box and moulded expanded polystyrene box with ventilation holes.

12.1 CLOSURE AND REINFORCEMENT

The Corrugated Fibre Board boxes are to be closed by folding the top flaps and by application of pressure sensitive tape. The telescopic boxes are closed by placing the lid on top. For reinforcement, the boxes are to be provided with two heat sealable synthetic straps.

12.2 TECHNICAL SPECIFICATIONS

The specification details of the recommended consumer packaging materials are given in Annexure XVI.

The box specifications for transport pack for consumer pack and direct bulk pack are drawn up with respect to box style, dimensions, type of fluting, grammage of board, bursting strength of the board, burst factor and cobb value of the board and compression strength of the box.. The type of ventilation to be provided has also been indicated.

The specification details for transport pack for consumer packs are given in Annexure XVII. to Annexure XIX. The specification details of partitions and separator plates are given in Annexure XX .

The specification details for direct bulk pack are given in Annexure XXI to Annexure XXII.

Specification details of pressure sensitive tape and reinforcement strap are given in Annexure-XXIII.

The specification details for Expanded Polystyrene box are given in Annexure– XXIV.

ANNEXURES

ANNEXURE I

SHELF-LIFE STUDIES OF KIWI AT 27 +/- 1°C

PACKAGING MATERIAL : MICRO-PERFORATED PLASTIC POUCH

No of Days	Physiological Loss in Weight (%)	Total Soluble Solids (TSS) in °Brix	Observation
0	0.00	16.87	-
2	0.87	16.69	No Change
4	1.45	17.02	No Change
6	2.03	16.89	No Change
8	2.91	16.74	No Change
10	3.78	16.82	No Change
12	4.65	17.04	No Change
14	6.10	16.81	No Change
16	7.47	16.74	No Change
18	8.23	16.90	Softening of the fruit observed

ANNEXURE II

SHELF-LIFE STUDIES OF KIWI AT 27 +/- 1°C

PACKAGING MATERIAL : PLASTIC PUNNET WITH LID

No of Days	Physiological Loss in Weight (%)	Total Soluble Solids (TSS) in °Brix	Observation
0	0.00	13.61	-
2	2.06	13.95	No Change
4	4.41	14.22	No Change
6	5.88	13.87	No Change
8	7.65	14.15	No Change
10	8.52	14.32	No Change
12	9.88	14.10	Softening of the fruit observed

ANNEXURE III

SHELF-LIFE STUDIES OF KIWI AT 27 +/- 1°C

PACKAGING MATERIAL : EPS / MOULDED PULP TRAY WITH STRETCH /CLING FILM

No of Days	Physiological Loss in Weight (%)	Total Soluble Solids (TSS) in °Brix	Observation
0	0.00	13.00	-
2	0.60	13.60	No Change
4	0.93	14.42	No Change
6	1.28	14.70	No Change
8	1.57	15.65	No Change
10	2.17	16.08	No Change
12	2.23	16.95	No Change
14	2.67	16.73	No Change
16	3.06	16.81	No Change
18	3.65	17.15	Softening of the fruit observed

ANNEXURE IV

SHELF-LIFE STUDIES OF KIWI AT 27 +/- 1°C

PACKAGING MATERIAL : EXTRUDED PLASTIC TUBULAR NET BAG (NETLON BAG)

No of Days	Physiological Loss in Weight (%)	Total Soluble Solids (TSS) in °Brix	Observation
0	0.00	14.00	-
2	2.78	14.86	No Change
4	5.56	14 43	No Change
6	6.89	14.73	No Change
8	7.41	15.15	No Change
10	8.63	15.45	No Change
12	9.26	15.63	Softening of the fruit observed

ANNEXURE V

SHELF-LIFE STUDIES OF KIWI AT 0 - 4°C

PACKAGING MATERIAL : MICRO-PERFORATED PLASTIC POUCH

No of Days	Physiological Loss in Weight (%)	Total Soluble Solids (TSS) in °Brix	Observation
0	0.00	14.75	-
2	0.00	15.10	No Change
4	0.18	14.95	No Change
6	0.18	15.42	No Change
9	0.18	15.65	No Change
11	0.18	15.51	No Change
13	0.18	15.67	No Change
16	0.18	15.13	No Change
18	0.18	14.84	No Change
20	0.37	15.95	No Change
23	0.37	14.79	No Change
26	0.43	15.25	No Change
28	0.52	14.95	No Change
32	0.55	15.44	No Change
34	0.55	15.75	No Change
36	0.62	14.87	No Change
38	0.62	15.89	No Change
40	0.62	15.56	No Change
42	0.80	15.95	No Change
44	0.80	15.95	No Change
46	0.80	15.87	Softening of the fruit observed

ANNEXURE VI

SHELF-LIFE STUDIES OF KIWI AT 0 - 4°C

PACKAGING MATERIAL : PLASTIC PUNNET WITH LID

No of Days	Physiological Loss in Weight (%)	Total Soluble Solids (TSS) in °Brix	Observation
0	0.00	14.95	-
2	0.14	15.43	No Change
4	0.57	15.76	No Change
6	0.57	14.85	No Change
9	0.71	14.75	No Change
11	1.00	15.34	No Change
13	1.29	15.67	No Change
16	1.36	15.30	No Change
18	1.64	14.95	No Change
20	1.93	15.63	No Change
23	2.00	15..75	No Change
26	2.14	15.83	No Change
28	2.43	15.65	No Change
32	2.51	15.65	No Change
34	2.71	15.13	No Change
36	2.84	15.43	No Change
38	3.14	15.80	Softening of the fruit observed

ANNEXURE VII

SHELF-LIFE STUDIES OF KIWI AT 0 - 4°C

PACKAGING MATERIAL : EPS / MOULDED PULP TRAY WITH STRETCH /CLING FILM

No of Days	Physiological Loss in Weight (%)	Total Soluble Solids (TSS) in °Brix	Observation
0	0.00	15.10	-
2	0.00	15.45	No Change
4	0.07	14.87	No Change
6	0.07	15.42	No Change
9	0.07	15.25	No Change
11	0.07	15.84	No Change
13	0.07	14.95	No Change
16	0.07	15.45	No Change
18	0.07	15.56	No Change
20	0.20	15.25	No Change
23	0.20	15.74	No Change
26	0.20	15.85	No Change
28	0.20	15.80	No Change
32	0.20	15.80	No Change
34	0.20	15.76	No Change
36	0.20	15.35	No Change
38	0.20	15.56	No Change
40	0.20	15.82	No Change
42	0.20	15.73	No Change
44	0.20	15.54	No Change
46	0.20	15.80	Softening of the fruit observed

ANNEXURE VIII

SHELF-LIFE STUDIES OF KIWI AT 0 - 4°C

PACKAGING MATERIAL : EXTRUDED PLASTIC TUBULAR NET BAG (NETLON BAG)

No of Days	Physiological Loss in Weight (%)	Total Soluble Solids (TSS) in °Brix	Observation
0	0.00	14.75	-
2	0.31	15.43	No Change
4	0.31	15.63	No Change
6	0.61	15.84	No Change
9	0.69	15.25	No Change
11	0.84	15.37	No Change
13	1.14	15.64	No Change
16	1.45	15.45	No Change
18	1.61	15.73	No Change
20	1.69	15.25	No Change
23	1.85	15.59	No Change
26	2.00	15.78	No Change
28	2.00	15.80	No Change
32	2.59	15.80	No Change
34	2.82	16.32	No Change
36	2.90	16.17	No Change
38	3.21	16.45	Softening of the fruit observed

ANNEXURE IX

SHELF - LIFE OF KIWI (IN DAYS)

SR. NO	MATERIAL	KIWIS EXPOSED TO 0 - 4 °C	KIWIS EXPOSED TO 27+ / -2 °C
1.	Micro-perforated plastic pouch	44	16
2.	Plastic Punnet with lid	36	10
3.	EPS / moulded pulp tray with stretch /cling film	44	16
4.	Extruded plastic tubular net bag (netlon bag)	36	10

ANNEXURE X

DIMENSIONS OF CONSUMER PACKS

A) Micro-perforated plastic pouch

CAPACITY	EMPTY POUCH *		FILLED POUCH *		
	Length (l)	Width (b)	Length (l)	Width(b)	H eight (h)
6 nos.	410	290	155	145	65
12 nos.	410	290	155	145	80

*** Includes 5 mm seal width on sides and bottom**

B) Plastic Punnet with Lid

CAPACITY	PUNNET SIZE					
	TRAY(mm)			LID(mm)		
	Length (l)	Width (b)	Hieght (h)	Length (l)	Width (b)	Hieght (h)
6 nos.	190	115	65	To fit the tray	To fit the tray	-
12 nos.	190	115	90	To fit the tray	To fit the tray	-

C) EPS / Moulded pulp tray with stretch /cling film

CAPACITY	TRAY SIZE		
	Length (l)	Width (b)	Hieght (h)
6 nos.	212	135	50
12 nos.	212	135	85

D) Extruded plastic tubular net bag (netlon bag)

CAPACITY	EMPTY BAG		FILLED BAG		
	Length (l)	Width (b)	Length (l)	Width(b)	H eight (h)
6 nos.	430	60	155	145	40
12 nos.	430	60	155	145	80

ANNEXURE XI

DIMENSIONS OF TRANSPORT PACK FOR CONSUMER PACKS

NO.	TYPE OF CONSUMER PACK	CAPACITY OF CONSUMER PACK	EXTERNAL DIMENSIONS OF TRANSPORT PACK (mm) L x B x H
1.	Micro-perforated plastic pouch	6 nos.	470 x 310 x 130
		12 nos.	470 x 310 x 100
2.	Plastic Punnet with lid	6 nos.	485 x 420 x 50
		12 nos.	485 x 420 x 100
3.	EPS / moulded pulp tray with stretch /cling film	6 nos.	545 x 460 x 80
		12 nos.	545 x 460 x 100
4.	Extruded plastic tubular net bag (netlon bag)	6 nos.	470 x 310 x 80
		12 nos.	470 x 310 x 120

ANNEXURE XII

PLACEMENT OF CONSUMER PACKS IN TRANSPORT PACKS

SR NO.	TYPE OF COMSUMER PACK	CAPACITY OF CONSUMER PACK	DIMENSIONS OF FILLED PACK	EXTERNAL DIMENSIONS OF THE BOX L x b x h(mm)	PLACEMENT PATTERN	NET WEIGHT OF CONTENTS (kg)
1.	Micro-perforated plastic pouch	6 nos.	155 x 145 x 65	470 x 310 x 80	3l x 2w x2h	6.00
		12 nos.	155 x 145 x 80	470 x 310 x 120	3l x 2w x1h	6.00
2.	Plastic Punnet with lid	6 nos.	190 x 115 x 65	485 x 420 x 50	4l x 2w x 1h	3.00
		12 nos.	190 x 115 x 90	485 x 420 x 100	4l x 2w x 1h	6.00
3.	EPS / moulded pulp tray with stretch /cling film	6 nos.	212 x 135 x 50	545 x 460 x 80	4l x 2w x 1h	3.00
		12 nos.	212 x 135 x 85	545 x 460 x 100	4l x 2w x 1h	6.00
4.	Extruded plastic tubular net bag (netlon bag)	6 nos.	155 x 145 x 60	470 x 310 x 80	3l x 2w x2h	6.00
		12 nos.	155 x 145 x 80	470 x 310 x 120	3l x 2w x1h	6.00

ANNEXURE XIII

RECOMMENDED DIMENSIONS FOR DIRECT BULK PACKS

SR. NO.	TYPE OF BOX	CAPACITY (KG)	EXTERNAL DIMENSIONS OF BULK PACK L x W x H (mm)
1.	RSC style CFB Box	5.00	370 x 260 x 130
2.	EPS / moulded pulp tray with stretch /cling film placed inside RSC style CFB Box	2.00	510 x 330 x 110
3.	Moulded Expanded Polystyrene Box	5.00	390 x 320 x 150

ANNEXURE XIV

PALLETISATION DETAILS

S.NO	TYPE OF COMSUMER PACK	EXTERNAL DIMENSIONS OF THE BOX LXBXH(mm)	TYPE OF PALLET	NO. OF BOXES PER LAYER (ON BASE)	ARRANGEMENT OF BOXES ON PALLET BASE (LXW)	BASE AREA UTILISATION (%)
1.	Micro perforated bags (6 Nos.)	470 x 310 x 80	IATA-A IATA-B EURO-A EURO-B	36 42 6 4	6 x 6 (L x W) 6 x 7 (L x W) 2 x 3 (L x W) 2 x 2 (L x W)	80.21 85.18 72.85 60.71
2.	Micro perforated bags (12 Nos.)	470 x 310 x 120	IATA-A IATA-B EURO-A EURO-B	36 42 6 4	6 x 6 (L x W) 6 x 7 (L x W) 2 x 3 (L x W) 2 x 2 (L x W)	85.18 72.85 60.71 85.88
3.	Plastic Punnet in tuck-in type box (6 Nos.)	485 x 420 x 50	IATA-A IATA-B EURO-A EURO-B	30 30 4 2	6 x 5 (L x W) 6 x 5 (L x W) 2 x 2 (W x L) 2 x 1 (W x L)	93.45 85.07 67.90 42.44
4.	Punnets in tuck-in type box (12 Nos.)	485 x 420 x 100	IATA-A IATA-B EURO-A EURO-B	30 30 4 2	6 x 5 (L x W) 6 x 5 (L x W) 2 x 2 (W x L) 2 x 1 (W x L)	93.45 85.07 67.90 42.44
5.	EPS / moulded pulp tray with stretch /cling film (6 Nos.)	545 x 460 x 80	IATA-A IATA-B EURO-A EURO-B	20 25 4 2	5 x 4 (L x W) 5 x 5 (L x W) 2 x 2 (W x L) 2 x 1 (W x L)	76.68 87.24 83.57 52.23
6.	EPS / moulded pulp tray with stretch /cling film (12 Nos.)	545 x 460 x 100	IATA-A IATA-B EURO-A EURO-B	20 25 4 2	5 x 4 (L x W) 5 x 5 (L x W) 2 x 2 (W x L) 2 x 1 (W x L)	76.68 87.24 83.57 52.23

S.NO	TYPE OF COMSUMER PACK	EXTERNAL DIMENSIONS OF THE BOX LXBXH(mm)	TYPE OF PALLET	NO. OF BOXES PER LAYER (ON BASE)	ARRANGEMENT OF BOXES ON PALLET BASE (LXW)	BASE AREA UTILISATION (%)
7.	Extruded plastic tubular net bag (netlon bag) (6 nos.)	470 x 310 x 80	IATA-A IATA-B EURO-A EURO-B	36 42 6 4	9 x 4 (L x W) 6 x 7 (L x W) 2 x 3 (L x W) 2 x 2 (W x L)	80.21 85.18 72.85 50.71
8	Extruded plastic tubular net bag (netlon bag) (12 nos.)	470 x 310 x 120	IATA-A IATA-B EURO-A EURO-B	36 42 6 4	9 x 4 (L x W) 6 x 7 (L x W) 2 x 3 (L x W) 2 x 2 (W x L)	80.21 85.18 72.85 50.71
9.	Direct Bulk Pack in CFB box	370 x 260 x 130	IATA-A IATA-B EURO-A EURO-B	64 72 9 8	8 x 8 (L x W) 8 x 9 (L x W) 3 x 3 (L x W) 4 x 2 (W x L)	94.15 96.42 72.15 80.17
10.	EPS Box	390 x 320 x 150	IATA-A IATA-B EURO-A EURO-B	45 54 9 6	9 x 5 (W x L) 9 x 6 (W x L) 3 x 3 (L x W) 3 x 2 (W x L)	85.88 93.81 93.60 78.00
11.	Moulded plastic / pulp tray in CFB box	510 x 330 x 110	IATA-A IATA-B EURO-A EURO-B	36 42 6 4	6 x 6 (L x W) 6 x 7 (L x W) 2 x 3 (L x W) 2 x 2 (L x W)	92.65 98.40 84.15 70.13

ANNEXURE XV

EVALUATION OF PROTOTYPES FOR TRANSPORT WORTHINESS TRIALS

TYPE OF PACK	VIBRATION TEST	EXTERNAL OBSERVATIONS	INTERNAL OBSERVATIONS WERE TAKEN AT THE END OF THE TEST
Prototype 1 - one piece tuck in type CFB Box in which 6 nos. of kiwis packed in plastic punnets are placed in 4 x 2 manner.	The packs were kept on the vibration table and vibrated for 1 hour Frequency: 180 c.p.m Amplitude 2.54 cm	No damage	No damage was observed to the kiwis
Prototype 2 - one piece tuck in type CFB Box in which 6 nos. of kiwis packed in EPS/ moulded pulp trays are placed in 4 x 2 manner.		No damage	No damage was observed to the kiwis
Prototype 3 - RSC style corrugated fibre board box in which 6 nos. of kiwis in micro-perforated pouches are placed in 3 x 2 manner.		No damage	No damage was observed to the kiwis
Prototype 4 - RSC style corrugated fibre board box in which 6 nos. of kiwis packed in extruded plastic tubular net bag (Netlon Bag) are placed in 3 x 2 manner.		No damage	No damage was observed to the kiwis
Prototype 5 - one piece tuck in type CFB Box in which 12 nos. of kiwis packed in plastic punnets are placed in 4 x 2 manner		No damage	No damage was observed to the kiwis

TYPE OF PACK	VIBRATION TEST	EXTERNAL OBSERVATIONS	INTERNAL OBSERVATIONS WERE TAKEN AT THE END OF THE TEST
Prototype 6 - one piece tuck in type CFB Box in which 12 nos. of kiwis packed in EPS/ moulded pulp trays are placed in 4 x 2 manner.	The packs were kept on the vibration table and vibrated for 1 hour Frequency: 180 c.p.m Amplitude 2.54 cm	No damage	No damage was observed to the kiwis
Prototype 7 - RSC style corrugated fibre board box in which 12 nos. of kiwis in micro-perforated pouches are placed in 3 x 2 manner.		No damage	No damage was observed to the kiwis
Prototype 8 RSC style corrugated fibre board box in which 12 nos. of kiwis packed in extruded plastic tubular net bag (Netlon Bag) are placed in 3 x 2 manner.		No damage	No damage was observed to the kiwis
Prototype 9 - RSC style corrugated fibre board box in which the kiwis are placed directly in the box.		No damage	No damage was observed to the kiwis
Prototype 10 - RSC style corrugated fibre board box in which the kiwis are individually placed in moulded pulp trays		No damage	No damage was observed to the kiwis
Prototype 11 - moulded expanded polystyrene box having ventilation holes.		No damage	No damage was observed to the kiwis

ANNEXURE-XVI

SPECIFICATION DETAILS FOR CONSUMER PACKS

A. MICRO-PERFORATED PLASTIC POUCH

Material of pouch	:	LDPE or PP
Thickness (μ)	:	37.5 or 25
Type of pouch	:	Pillow pouch
Seal Width	:	5 mm (Minimum)

Note:

1. Tolerance

a) Permissible Lower Level

Polyethylene film (-1.0%)

Polypropylene film (-1.0%)

b) Upper Level

A higher specification (positive tolerance) always could be acceptable but however should not lead to high rigidity, flex crack or reduced seal strength. A higher specification may add to the cost.

2. The material could be transparent/opaque coloured as per the requirements of the importer.

3. The material used shall be food grade and pass the prescribed Indian Standard/Standards if any and as demanded by the importing countries.

4. Printing requirements shall conform to as prescribed by the importing countries.

5. General Observations: The pouches shall be clean and without any foreign particle.

a) The seal width shall be minimum 5 mm, particularly the top seal (for filled pouches).

b) The pouches shall be either reverse or surface printed. In case of surface print, the print shall be compatible with the product and shall not lift or smudge. The print shall be legible and easy to read.

B. EPS Tray

Material of construction	:	(EPS) Expanded Polystyrene
Density (g/cc)	:	0.08
Thickness	:	Not more than 5 mm

C. Stretch Film

Material : Food grade, Odourless, Stretchable

LDPE : (Low density polyethylene)

or

LLDPE : (Linear low density polyethylene)

or

PVC : (Polyvinyl chloride) film.

Thickness (μ) : 15.00

ANNEXURE XVII

SPECIFICATION DETAILS FOR TRANSPORT PACK FOR CONSUMER PACKS

TYPE OF CONSUMER PACK : MICRO-PERFORATED PLASTIC POUCH

CAPACITY OF CONSUMER PACK : 6 NOS. OF KIWIS

MATERIAL OF CONSTRUCTION *	Corrugated Fibre Board	Corrugated Fibre Board
EXTERNAL DIMENSIONS (mm)	470 x 310 x 80	470 x 310 x 80
STYLE OF BOX * *	RSC - 0201	Telescopic – 0312 & 0306
NO. OF PLIES	3.0	Lid - 3 Tray - 3
TYPE OF FLUTES	B (Narrow)	Lid B (Narrow) Tray B (Narrow)
DIRECTION OF FLUTES	Vertical	Vertical
GRAMMAGE (G/M SQ.) OUTER TO INNER (INDICATIVE)	250 / 150 / 150	Lid : 250/150/150 Tray : 250/150/150
BURST FACTOR OF PAPER (KRAFT) (MINIMUM)	20.0	20.0
BURSTING STRENGTH OF BOARD (KG/ CM.SQ)(MINIMUM)	11.0	Lid : 11.0 Tray : 11.0
NO. OF PIECES PER BOX	Not more than two	Not more than two
MANUFACTURE'S JOINT	By gluing	By gluing
EDGE CRUSH (KGF)(MIN)	30.00	30.00
COMPRESSION STRENGTH OF BOX (KGF) (MINIMUM)	350	350
COBB (30 MINUTES) * * * (G /M SQ.) (MAXIMUM)	60	60
NO. OF VENTILATION HOLES	16.0	16.0
DIAMETER (MM) OF POSITION OF HOLES TWO SIDES EACH TWO ENDS EACH TOP & BOTTOM EACH	20.0 3 1 4	20.0 3 1 4

* Outer ply of white duplex board or bleached kraft

** Or any other suitable style which provides equal strength and performance

*** Outer ply to be laminated or coated for water proofing

Note : Dimensions of the box are modular to Euro pallets. However, any other dimensions or box styles to suit importers requirements could also be used.

ANNEXURE XVIII

SPECIFICATION DETAILS FOR TRANSPORT PACK FOR CONSUMER PACKS

TYPE OF CONSUMER PACK : MICRO-PERFORATED PLASTIC POUCH

CAPACITY OF CONSUMER PACK : 12 NOS. OF KIWIS

MATERIAL OF CONSTRUCTION *	Corrugated Fibre Board	Corrugated Fibre Board
EXTERNAL DIMENSIONS (mm)	470 x 310 x 120	470 x 310 x 120
STYLE OF BOX * *	RSC - 0201	Telescopic – 0312 & 0306
NO. OF PLIES	3.0	Lid - 3 Tray - 3
TYPE OF FLUTES	B (Narrow)	Lid B (Narrow) Tray B (Narrow))
DIRECTION OF FLUTES	Vertical	Vertical
GRAMMAGE (G/M SQ.) OUTER TO INNER (INDICATIVE)	250 / 150 / 150	Lid : 250/150/150 Tray : 250/150/150
BURST FACTOR OF PAPER (KRAFT) (MINIMUM)	20.0	20.0
BURSTING STRENGTH OF BOARD (KG/ CM.SQ)(MINIMUM)	11.0	Lid : 11.0 Tray : 11.0
NO. OF PIECES PER BOX	Not more than two	Not more than two
MANUFACTURE'S JOINT	By gluing	By gluing
EDGE CRUSH (KGF)(MIN)	30.00	30.00
COMPRESSION STRENGTH OF BOX (KGF) (MINIMUM)	350	350
COBB (30 MINUTES) * * * (G /M SQ.) (MAXIMUM)	60	60
NO. OF VENTILATION HOLES	16.0	16.0
DIAMETER (MM) OF POSITION OF HOLES **TWO SIDES EACH** **TWO ENDS EACH** **TOP & BOTTOM EACH**	20.0 3 1 4	20.0 3 1 4

* Outer ply of white duplex board or bleached kraft

** Or any other suitable style which provides equal strength and performance

*** Outer ply to be laminated or coated for water proofing

Note : Dimensions of the box are modular to Euro pallets. However, any other dimensions or box styles to suit importers requirements could also be used.

ANNEXURE XIX

SPECIFICATION DETAILS FOR TRANSPORT PACK FOR CONSUMER PACKS

TYPE OF CONSUMER PACK : EPS / MOULDED PULP TRAY WITH STRETCH /CLING FILM

CAPACITY OF CONSUMER PACK: 6 NOS. & 12 NOS. OF KIWIS

MATERIAL OF CONSTRUCTION *	Corrugated FibreBoard
EXTERNAL DIMENSIONS (mm)	6 nos. - 545 x 460 x 80 12 nos. - 545 x 460 x 100
STYLE OF BOX * *	One piece tuck-in-type
NO. OF PLIES	3.0
TYPE OF FLUTES	B (Narrow)
DIRECTION OF FLUTES	Vertical
GRAMMAGE (G/M SQ.) OUTER TO INNER (INDICATIVE)	250 / 150 / 150
BURST FACTOR OF PAPER (KRAFT) (MINIMUM)	20.0
BURSTING STRENGTH OF BOARD (KG/ CM.SQ)(MINIMUM)	11.0
NO. OF PIECES PER BOX	One
MANUFACTURE'S JOINT	By gluing
EDGE CRUSH (KGF)(MIN)	25.00
COMPRESSION STRENGTH OF BOX (KGF) (MINIMUM)	350
COBB (30 MINUTES) * * * (G /M SQ.) (MAXIMUM)	60
NO. OF VENTILATION HOLES	19.0
DIAMETER (MM) OF POSITION OF HOLES	20.00

* Outer ply of white duplex board or bleached kraft.

** Or any other suitable style which provides equal strength and performance

*** Outer ply to be laminated or coated for water proofing.

Note : Dimensions of the box are modular to Euro pallets. However, any other dimensions or box styles to suit importers requirements could also be used.

ANNEXURE XX

SPECIFICATION DETAILS FOR PARTITIONS AND SEPARATOR PLATES

1. PARTITIONS

MATERIAL OF CONSTRUCTION	:	Corrugated Fibre Board
NO. OF PLIES	:	3
TYPE OF FLUTE	:	B (Narrow)
GRAMMAGE (g/m^2)	:	150/150/150
BURSTING STRENGTH (kg/cm.sq) (minimum)	:	5.00

2. SEPARATOR PLATES

MATERIAL OF CONSTRUCTION	:	Corrugated Fibre Board
NO. OF PLIES	:	Three
TYPE OF FLUTE	:	B (narrow)
GRAMMAGE (G/M^2)	:	100/100/100
BURSTING STRENGTH (KG/CM.SQ) (MIN)	:	5.00

ANNEXURE XXI

SPECIFICATION DETAILS FOR PACKAGING OF KIWIS (DIRECT BULK PACK)

CAPACITY : 5 kgs

Material of Construction *	Corrugated Fibre Board	Corrugated Fibre Board	Corrugated Fibre Board
EXTERNAL DIMENSIONS (mm)	370 x 260 x 130	370 x 260 x 130	370 x 260 x 130
STYLE OF BOX * *	RSC - 0201	Telescopic - 0306	Telescopic - 0312
NO. OF PLIES	3.0	Lid - 3 Tray - 3	Lid - 3 Tray - 3
TYPE OF FLUTES	B (Narrow)	Lid B (Narrow) Tray B (Narrow)	Lid B (Narrow) Tray B (Narrow)
DIRECTION OF FLUTES	Vertical	Vertical	Vertical
GRAMMAGE (G/M SQ.) OUTER TO INNER (INDICATIVE)	250 / 150 / 150	Lid : 250/150/150 Tray : 250/150/150	Lid : 250/150/150 Tray : 250/150/150
BURST FACTOR OF PAPER (KRAFT) (MINIMUM)	20.0	20.0	20.0
BURSTING STRENGTH OF BOARD (KG/ CM.SQ) (MINIMUM)	11.0	Lid : 11.0 Tray : 11.0	Lid : 11.0 Tray : 11.0
NO. OF PIECES PER BOX	Not more than two	Not more than two	Not more than two
MANUFACTURE'S JOINT	By gluing	By gluing	By gluing
EDGE CRUSH (KGF) (MIN)	50.00	50.00	50.00
COMPRESSION STRENGTH OF BOX (KGF) (MINIMUM)	350	350	350
COBB (30 MINUTES) * * * (G /M SQ.) (MAXIMUM)	60	60	60
NO. OF VENTILATION HOLES	16.0	16.0	16.0
DIAMETER (MM) OF POSITION OF HOLES TWO SIDES EACH TWO ENDS EACH TOP & BOTTOM EACH	20.0 3 1 4	20.0 3 1 4	20.0 3 1 4

* Outer ply of white duplex board or bleached kraft

** Or any other suitable style which provides equal strength and performance

*** Outer ply to be laminated or coated for water proofing

ANNEXURE XXII

SPECIFICATION DETAILS FOR PACKAGING OF KIWIS (DIRECT BULK PACK)

CAPACITY:2 KGS (KIWIS PLACED INDIVIDUALLY IN MOULDED PLASTIC/ PULP TRAY

Material of Construction *	Corrugated Fibre Board	Corrugated Fibre Board	Corrugated Fibre Board
EXTERNAL DIMENSIONS (mm)	510 x 330 x 110	510 x 330 x 110	510 x 330 x 110
STYLE OF BOX * *	RSC - 0201	Telescopic - 0306	Telescopic - 0312
NO. OF PLIES	3.0	Lid - 3 Tray - 3	Lid - 3 Tray - 3
TYPE OF FLUTES	B (Narrow)	Lid B (Narrow) Tray B (Narrow)	Lid B (Narrow) Tray B (Narrow)
DIRECTION OF FLUTES	Vertical	Vertical	Vertical
GRAMMAGE (G/M SQ.) OUTER TO INNER (INDICATIVE)	250 / 150 / 150	Lid : 250/150/150 Tray : 250/150/150	Lid : 250/150/150 Tray : 250/150/150
BURST FACTOR OF PAPER (KRAFT) (MINIMUM)	20.0	20.0	20.0
BURSTING STRENGTH OF BOARD (KG/ CM.SQ) (MINIMUM)	11.0	Lid : 11.0 Tray : 11.0	Lid : 11.0 Tray : 11.0
NO. OF PIECES PER BOX	Not more than two	Not more than two	Not more than two
MANUFACTURE'S JOINT	By gluing	By gluing	By gluing
EDGE CRUSH (KGF) (MIN)	50.00	50.00	50.00
COMPRESSION STRENGTH OF BOX (KGF) (MINIMUM)	350	350	350
COBB (30 MINUTES) * * * (G /M SQ.) (MAXIMUM)	60	60	60
NO. OF VENTILATION HOLES	16.0	16.0	16.0
DIAMETER (MM) OF POSITION OF HOLES TWO SIDES EACH TWO ENDS EACH TOP & BOTTOM EACH	20.0 3 1 4	20.0 3 1 4	20.0 3 1 4

* Outer ply of white duplex board or bleached kraft

** Or any other suitable style which provides equal strength and performance

*** Outer ply to be laminated or coated for water proofing

ANNEXURE XXIII

SPECIFICATION DETAILS FOR PRESSURE SENSITIVE TAPE AND REINFORCEMENT STRAP

1. PRESSURE SENSITIVE TAPE

MATERIAL	:	BOPP /PVC
THICKNESS (μ)	:	20
WIDTH	:	50 mm

Adhesive property to pass as per I S:3676-1986

For further specification details refer IS: 2880-1978

2. REINFORCEMENT STRAP

MATERIAL OF CONSTRUCTION	:	Polypropylene
WIDTH (MIN)	:	12 mm
THICKNESS (MIN)	:	0.05 mm
BREAKING LOAD (MIN.)	:	80 kg/12 mm width
ELONGATION (MAX)	:	25%

ANNEXURE XXIV

SPECIFICATION DETAILS OF DIRECT BULK PACK

CAPACITY : 5 Kg

MATERIAL OF CONSTRUCTION	: Expanded Polystyrene
EXTERNAL DIMENSIONS (mm)	: 390 x 320 x 180
STYLE OF BOX *	: Lid & Tray
DENSITY OF EPS (g/cc)	: 0.32
NO. OF PIECES PER BOX	: Not more than two
COMPRESSION STRENGTH (kgf) (minimum)	: 300.00
NO. OF VENTILATION HOLES	: 16.00
DIAMETER (mm) & POSITION OF HOLES	: 20.00
TWO SIDES EACH	: 3
TWO ENDS EACH	: 1
TOP &BOTTOM EACH	: 4

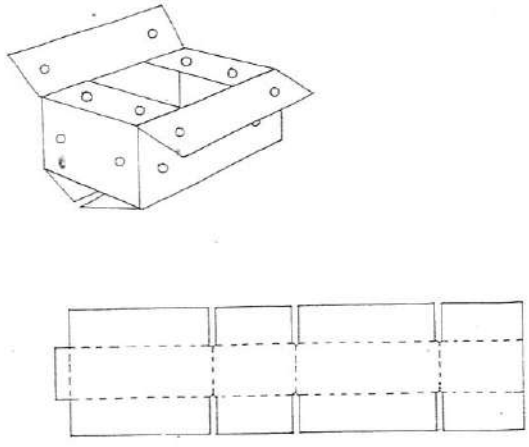
OR

Equivalent Ventilation

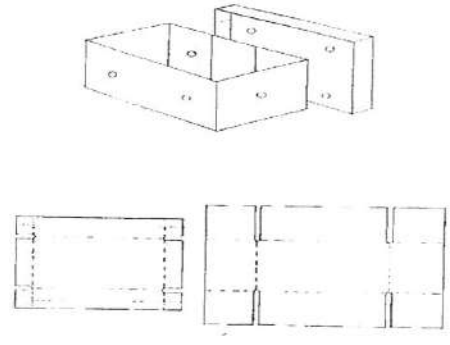
* Or any other suitable style with equal strength and performance

DRAWINGS

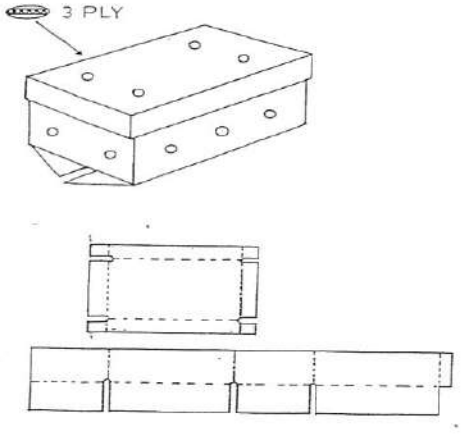
STYLE OF RECOMMENDED CFB BOXES



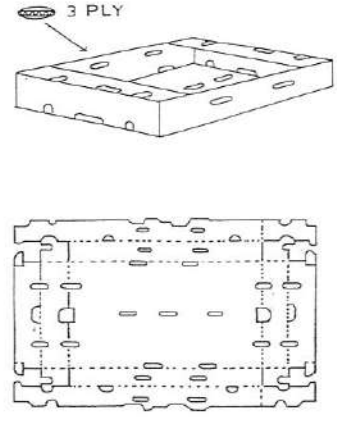
CFB BOX RSC TYPE (0201)



CFB BOX TELESCOPIC TYPE (0306)



CFB BOX TELESCOPIC TYPE (0312)



ONE PIECE TUCK – IN – TYPE BOX

PHOTOGRAPHS

DEVELOPMENT OF CONSUMER PACKS

PHOTOGRAPH – 1
6 NOS. KIWI PACKED IN MICRO-PERFORATED BAGS

PHOTOGRAPH – 2
12 NOS. KIWI PACKED IN MICRO-PERFORATED BAGS

PHOTOGRAPH – 3
6 NOS. KIWI PACKED IN PLASTIC PUNNET

PHOTOGRAPH – 4
12 NOS. KIWI PACKED IN PLASTIC PUNNETS

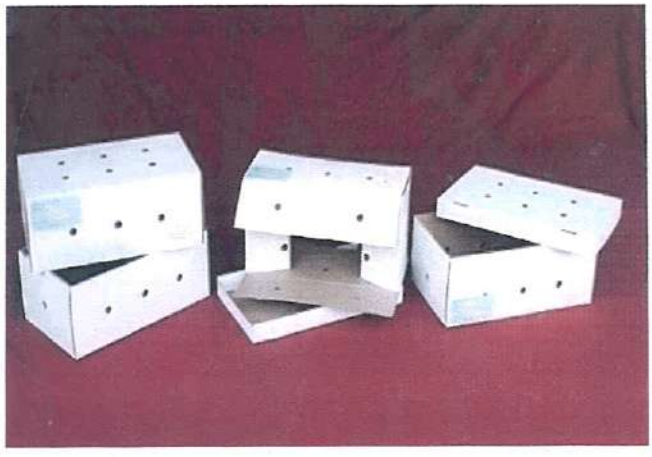
PHOTOGRAPH – 5
6 NOS. KIWI PACKED IN EPS TRAY STRETCH WRAPPED

PHOTOGRAPH – 6
12 NOS. KIWI PACKED IN EPS TRAY STRETCH WRAPPED

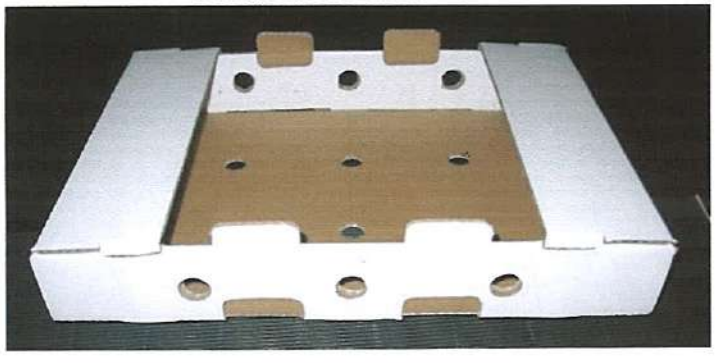
PHOTOGRAPH – 7
6 NOS. KIWI PACKED IN EXTRUDED PLASTIC TUBULAR NET BAG (NETLON BAG)

PHOTOGRAPH – 8
12 NOS. KIWI PACKED IN EXTRUDED PLASTIC TUBULAR NET BAG (NETLON BAG)

BOX STYLES CONSIDERED FOR DEVELOPMENT OF TRANSPORT PACK / DIRECT BULK PACKS (CFB) FOR KIWIS



PHOTOGRAPH – 9



PHOTOGRAPH – 10

PHOTOGRAPH – 11
DEVELOPMENT OF TRANSPORT PACK FOR CONSUMER PACKS

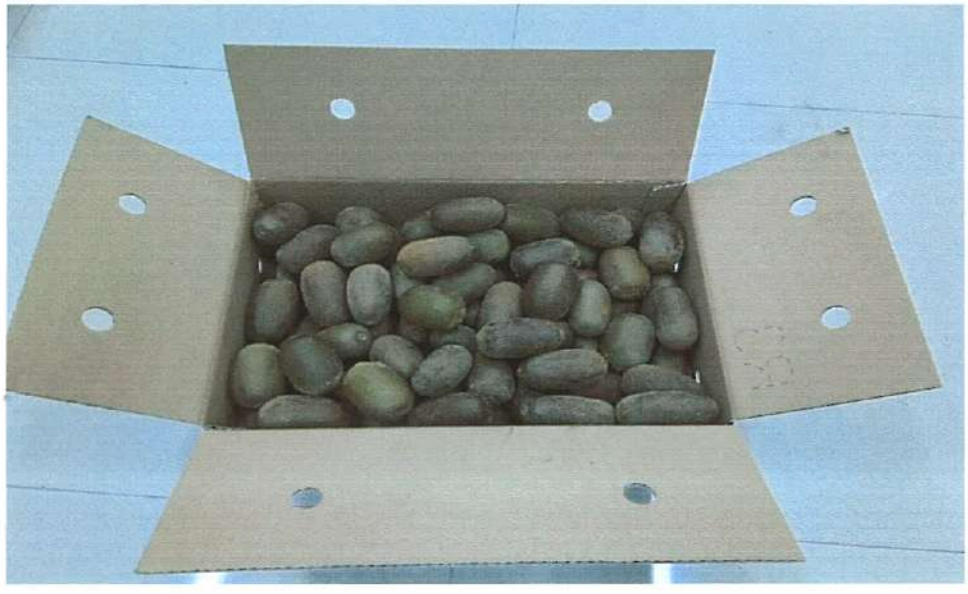
PHOTOGRAPH – 12
12 NOS. KIWI PACKED IN MICRO-PERFORATED BAGS AND PLACED CFB BOX

PHOTOGRAPH – 13
12 NOS. KIWI PACKED IN PLASTIC PUNNETS AND PLACED CFB BOX

PHOTOGRAPH – 14
12 NOS. KIWI PACKED IN EPS TRAY STRETCH WRAPPED AND PLACED CFB BOX

PHOTOGRAPH – 15
12 NOS. KIWI PACKED IN EXTRUDED NET BAG AND PLACED CFB BOX

DEVELOPMENT OF DIRECT BULK PACK



PHOTOGRAPH – 16
KIWIS PLACED CFB BOX

PHOTOGRAPH – 17
KIWIS PLACED INDIVIDUALLY IN MOULDED PLASTIC TRAY

PHOTOGRAPH – 18
KIWIS PLACED INDIVIDUALLY IN MOULDED PULP TRAY

PHOTOGRAPH – 19
KIWIS PLACED IN EXPANDED POLYSTYRENE BOX– TELESCOPIC STYLE (0306)