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**MOST ECONOMIC PACKAGING SYSTEMS AND UTILIZED TECHNIQUES
FOR THE CONTAINERIZATION OF AGRICULTURAL PRODUCTS^{1/}**

by

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Packaging systems as well as techniques used for storage or distribution of agricultural products are being evolved in Europe. Why ?
Mainly for rentability reasons, that is to say final cost decrease, and also for rationalization.

At the time being, agricultural goods are delivered always :

. In bulk, that is to say in bulk in a large container.

It appears that only a low tonnage is involved.
The whole handling operation particularly spoils the goods.
Citrus fruits are sometimes delivered in that way, but an inquiry seems necessary for knowing if the solution can be foreseen on a large scale.

. In containers for 10 to 20 kg

- Wooden containers

They represent certainly the most important part for this type of goods.
They may include or not a sheet of paper which covers the internal walls of the container.

The wooden containers themselves may be made entirely of wood (crate) or may have the 2 opposite small walls made of agglomerated wood.
There are such different channels to reach the retailers' shops that it is difficult to give details on the various types of packs. An inquiry would be necessary for knowing the interest of both mentioned packs.

- Corrugated board containers

(Solid cardboard is rarely used)

A lot of articles are used but their amount is less important.
Several types of boxes are used :

- . Folding cases with outer flaps only meeting and inner flaps grapping
- . Telescope boxes
- . Cases with small flaps
- . Telescope folding cases with flaps
- . and specially trays used for fruits as well as for vegetables.

For avoiding the loss of compression due to humidity, a lot of treatments have been tested or are still in progress. The main ones are :

- . Treatment in depth with resins (mainly escorez types)
- . Treatment of the liner boards :
 - Impregnation of wax (the quality of the wax is so important that generally a wax compound is preferred) - Several types of process are used.
 - Hot-melt coating
 - Low Density Polyethylene extrusion
- . Use of moisture-proof glues
- . Treatment on the finished corrugated board
 - Immersion in a wax bath
 - Hot air treatment + wax impregnation under vacuum (Secor process)

The knowledge concerning the difficulty of production of these types of treatment and the results of treated corrugated board is very important because it should help to decide if this pack is to be preferred or not to wooden containers.

In some cases, specially for delicate fruits, the containers in wood or in board contain several layers of goods which are protected by moulded sheets in cellulose, polystyrene or P.V.C.

- In large bags

Sometimes ago, these bags were only made of jute. But now, for a question of final price and also in order to avoid mould growth, they are made of woven stretched polypropylene.

. In units of 1 to 5 kg for instance, ready to be bought

The development of Hyper- and Super markets has permitted a large increase of these types of packs, - in spite of all attacks concerning pollution -, because, finally, they seem to represent the most suitable possibility for main reasons :

- avoiding of too many handlings
- certitude for the consumer to have an exact weight
- possibility always for the consumer to choose, which is very important, and even it can be said that it has become habitual.
- better administration of shops
- reduction of stealing
- and so on...
- They help the consumer to reduce the time of waiting (queue) and permit to decrease the number of shop-assistants.

The ready to be bought packs seem so important that a complete study of all the possibilities must be carried out for knowing the conclusions of, let say, the last 5 years.

The price of the packs themselves is so determinant that a lot of firms have worked quite a long time for arriving to find or new shapes or new machineries able to give an acceptable final price.

They are made of :

- solid board
- corrugated board treated or not according to the fragility of the goods ;
- wood
- injected or thermoformed plastics (polystyrene and several types of polyolefines)
- moulded pulp (cellulose)
- Expanded polystyrene made by vacuum forming or injection
- nets (vegetable or mainly now plastics fibres - Nylon - polypropylene)
- plastics bags (Low density polyethylene and now since one or 2 years, high density polyethylene).

Certain of these packs are overwrapped with the help of a shrunked or stretched low density polyethylene film.

Such an amount of packs being involved has permitted a lot of critics too, specially about pollution and loss of raw materials.

These attacks have been particularly strong because of the energy crisis and in a lot of countries, the Governments have designed special commissions to study the matter.

The work continues, the inquiry too. It is still too early to indicate the conclusions but it appears clearly that the interest of such ready to be bought packs is so important and let say evident that it is difficult to think that a regulation would restrict their use.

The point on pollution is certainly important specially if plastics are concerned. It is the reason why several trials are carried out for making bio-degradable polymers.

Practically, except for certain types of bags given in shops, no really available solution has been found even with the photo-degradable plastics. However, considering the importance of the pollution problem, the question must be closely followed.

For summing up, everybody, specially since the energy crisis, is interested in using the most economic packaging system, but when all the different possibilities, which are still used, are considered, that means that this question of final cost decrease is not so easy to solve.

It can however be said that in 2 or 3 years time, certain types of packs will be preferred to others. They will represent then the resultant for transportation and commercialization of goods.

Consequently, it appears that large efforts must be done in order to follow the present situation in Europe.

In case ready to be bought packs can be filled in certain Arab countries, a large new market of goods with added value may arise.

Point 2

Requirements for packaging for export in the European market of agricultural and sea products (bearing in mind forecasted evolutions)

Very often, buyers think, except perhaps for tins but certainly for plastics, that there is no requirement for packs.

This conclusion seems logical when all the possibilities of raw materials used for packs - and described in point 1 - are known.

These people have the habit to buy goods in such or such types of containers.

A quick inquiry, which might be thoroughly resumed, proves that these buyers finally choose their packs only according to the final protection they bring to the goods after all handling operations.

It is certainly a quite logical action for them especially because they have not to follow legislation.

The Common Market will certainly alter this position in the future.

General propositions for the Common Market

The Director responsible for Agriculture in the Common Market, has, with the help of experts from Member states and in the context of work being carried out by the Commission regarding the harmonization of laws relating to materials and articles intended to come into contact with foodstuffs, drawn up and submitted to the Council for approval a proposal for an outline Directive laying down general principles applicable to all materials. This directive is to be followed by a number of specific directives for the various types of materials and articles (e.g. pottery, glass, plastics, paper and cardboard...)

So far, work has been started on special directives relating to pottery, glass, cellulose film and plastics.

The specific directives concerning Cellulose film was the easiest to be defined. Perhaps, at the end of 1978, it will cover varnished and not varnished films and as far as we know, it will be the only one where the migration limits are not foreseen.

But for giving an idea of the complexity of these rules, it will indicate however certain percentages of cellulose plastifier and anti-oxygen agent.

The most important specific directive and the most difficult one concerns the plastics. A few lines about this question will help you to follow the aim of the European Council.

This paper considers the following points :

- . list of substances authorized for use in the manufacture of plastics materials and articles
- . determination of purity standards of certain substances authorized for the use in the manufacture of plastics materials and articles
- . Community methods of analysis to determine the specific and/or overall migration of constituents of plastics materials and articles.

Then

- . a complete list of simulants to be used in determining specific and/or overall migration
- . Other prescriptions

However, the directive does not cover complex materials and articles, i.e. composed of layers of different types materials, where the final layer, that intended to come into contact with the foodstuffs, is in plastics.

The question is still pending.

All the specifications have for aim to protect the goods and it is interesting to note that the description of foodstuffs includes among other things :

waters, fruit or vegetable juices of normal strength or concentrated, fruit nectars, wines, whole fruit (fresh or chilled), dried or dehydrated fruit, fruit in the form of chunks (purée, paste), fruit preserves (jams and similar products - whole fruit or chunks, preserved in liquid), whole vegetables (fresh or chilled), frozen or deep-frozen vegetables, animals and vegetable fats and oils, fish (fresh, chilled, salted, smoked - in the form of paste - dried, frozen or deep-frozen).

All these proposals must be known specially for the future, but it is interesting to speak more about P.V.C. problems because these resins are more and more used for plastics bottles for waters, wines and oils.

Since the 60's, certain specialists have shown that the V.C. monomer presented some drawbacks concerning health.

In the 70's, a cancerigene action has been suspected specially when this gas is breathed in.

In 1973 and 1974, some scientific work has finally proved the danger of this gas for humans and animals which have breathed it in during a long period.

Consequently, after several meetings, it has been decided to establish immediately rules concerning this monomer.

The big problem was to adopt analysis methods able to be applied for foodstuffs and for the most important part, by analysis laboratories, giving a detection of V.C. of 0.05 mg/kg in food or food simulating liquid.

Finally, at the end of December 1976, a commission has presented to the Council a draft proposal concerning the V.C. migration which gives the following limits :

- 1 ppm (1 mg/kg) in the pack in case of articles made of V.C. homopolymer
- 5 ppm (5 mg/kg) in the pack in case of articles made of V.C. copolymer
- 50 ppb (0,050 mg/kg) in the foodstuffs.

This draft proposal indicates how to determine the V.C. in food or in food simulating liquids.

The principle is as follows:

The vinyl chloride present in food or in food simulating liquids is determined by gas-liquid chromatography using the "head space" method after dilution or suspension in dimethylacetamide.

Present situation for plastics in general

Up till now the use of plastics is only possible if they are in conformity with the national requirement for countries where they are employed.

This knowledge is certainly necessary for countries which would like to export in the European market.

It is a too hard task to explain in a few lines the different actual requirements. It will then be only indicated some words about the regulations in some European countries.

In France, the requirements are very hard because the polymers authorized must be high polymers but insoluble and inert when they enter into contact with foodstuffs.

Even knowing that it is practically impossible, the requirements have been only slightly altered.

- For certain types of polymers, we have a list of permitted ingredients. These last ones concern :

- . anti-oxidizing agent
- . stabilizer
- . lubricant
- . anti- U.V.
- . antistatic agent
- . plastifier
- . fillers
- . Drying substance
- . dyes
- . pigments

In certain cases, limits of migration are given in overall or in percentage and only for some types of resins.

- An exception is given for the use of P.V.C. for which, since 10.7.75 the migration of V.C. is only 50 ppb(0.050 mg/kg of foodstuff).
- Always for P.V.C., all the mineral waters must receive a special clearance concerning the P.V.C. used for blowing.

This type of French law, we give as an example, must be interpreted in case the definition is not completely established.

Types of interpretation

- high polymers

No legal and no chemical definitions are available .

Practically, experts have the habit to consider that their molecular weight must be higher than 8000. In fact, the high polymers have very often more important molecular weights.

- migrations

As it is practically impossible to avoid migration, experts admit generally 60 mg / kg of total migration in the totality of the simulants which are pure water, acetic acid 3 %, ethylic alcohol 15 % and another one which must be sunflower or olive oils or even certain types of glycerids.

In West Germany, an official technical commission determines for every type of plastics requirements concerning the polymers and all their chemical ingredients. For these last ones, maximum percentages are often indicated and even, for certain cases, limits for specific or overall migrations are mentioned. These "Empfehlungen" are practically comparable to the "code of practice" used in England.

In the Netherlands, new requirements give rules which are very near to the European Council propositions.

In the United Kingdom, practically no requirement exists concerning the use of packs made of plastics and which come into contact with foodstuffs.

The British Plastics Federation in collaboration with the British Industrial Biological Research Association has set up directives which must be considered only as a "Code of Practice".

In its list, a number of plastics raw materials are mentioned in a special rubric "without any risk".

In any case, the producer is always responsible.

These actual requirements must practically be followed for the time being and when the new Common Market rules will be definitively adopted, European countries will be permitted to use their own requirements during the first 3 years. In case certain countries do not want to follow the new European rules, they must follow special proceedings explaining their position and after examination, the alteration will be agreed or not.

Sea products and other products in tins

Up till now, practically only a few products are imported from Arab countries. A short inquiry has shown that certain important problems continue to limit the possibilities of buyers.

The main difficulties seem to be :

- the size of the tins
- the lack of palletization which obliges to too many handlings.

About the rules, it appears that prescriptions concerning packaging are rare, but it could be considered that, in the future, the I.S.O. requirements will be indicated in the customer contracts. These requirements are still in progress and some words about them will be given during the meeting. Nevertheless, it appears that the knowledge of what is generally done in Europe concerning metal boxes is interesting to be known.

- General recommendations for empty boxes

- . A lot of precautions should be taken concerning empty boxes for avoiding all types of shocks and for the storage which must imperatively be located in dry places.
- . For identification of box bottoms, the best solution seems to put a mark with an indelible ink.

- General recommendations for filled boxes

- . Special care should be taken for avoiding damaged boxes which are refused for sale.
- . A lot of precautions are necessary for avoiding bacteriological contamination after sterilization. These precautions should be specially taken for avoiding micro-biological germs always present near the seams.
- . When boxes are labelled, glues must be chosen for avoiding rust. During the labelling operation, the pressure strength of the belts should be carefully controlled in order to have just the sufficient pressure for setting the labels.

- . As for empty boxes, the filled ones should be stored in correct conditions. The outer packages are generally in corrugated cardboard instead of wood which contains too much humidity. The choice of the corrugated board is very important. In case shrinkfilms are used, they must present holes in order to avoid condensation.
- . About the temperature of an ideal storage, it is considered that the limits are between 10 to 20 °C.

- List of several types of boxes generally used

1.- TINPLATE

The Euronorm 77-63 of October 1963 gives the definition of tinplate.

- . K-type tinplates are principally reserved for unvarnished boxes.
- . Varnishes are very often coated on tinplates for giving a better protection to the metal or to the product to be packed. These varnishes are chosen in conformity with the national laws concerning varnishes and plastics polymers coming into contact with foodstuffs. They must always guarantee a chemical inertness and a good adherence to the tin.

+ Types of boxes

- a/ boxes entirely made of plain tinplate
- b/ boxes with plain tinplate body and varnished bottom
- c/ boxes entirely made of varnished tinplate
- d/ boxes with two coatings of varnish.

The (a)type boxes are rarely employed for example when the presence of tin helps to preserve the colour of goods.

The (b)type boxes are the most currently employed especially for vegetables.

The (c)type boxes are used for certain vegetables.

The (d)type boxes give the maximum of security.

+ Classification of products allowing the choice of boxes

These products are classified in 3 groups :

- I- Rather unaggressive products
- II- Acid aggressive products
- III- Sulphuring products

In every group, it must be checked if the goods allow or not the contact with tin.

1.A. bearing the contact with tin :

Fruits, juices, rather unaggressive fruit marmalades, peaches, fruit mixtures, tomatoes (whole, concentrated or juice), fish in tomatoe sauce.

Practically the 4 types of boxes can be used. However for security reasons, (a) and (d) boxes are often chosen. Certain exceptions must be underlined concerning the use of complete varnished boxes for peaches and pears for which a change of colour may occur.

II.A. bearing the contact with tin :

Fruits, fruit juices as orange or pineapple, and so on...

(b) and (d) boxes can be used. (c) boxes are not sufficient for a long preservation.

II.B. not bearing the contact with tin :

Cherries

(d) boxes are necessary for avoiding the change of colour due to the tin.

III.A. Rather unaggressive sulphuring products bearing the contact with tin :

Peas, beans, sardines, tunny fish, corned beef

For these products, (a) boxes may be used but it is generally recommended to use (c) boxes which give a better presentation when opened.

III.B. Aggressive sulphuring products not bearing the contact with tin

Shell-fish and molluscs : lobster, crab...

(c) and (d) boxes are necessary.

2.- TIN FREE STEEL(TFS)

These boxes cannot be compared, from the point of view of corrosion, with tinplate ones. The lack of protection of steel by tin makes a varnish coating on both sides necessary.

They are of current use in certain countries for beer or carbonated beverages, but their use is still limited for other goods.

Embossed boxes for certain fish in oil can be mentioned.

3.- ALUMINIUM

The raw materials used belong to two alloyage families :

magnesium-aluminium and manganese-aluminium

These adjunctions to aluminium have for aim an easier manufacture of the boxes, giving a better mechanical resistance and reducing the susceptibility to corrosion.

A chemical or an electro-chemical way allows to prepare the surface for coating.

All these types of metals are always varnished on both sides. These coatings are necessary specially for protecting aluminium itself, for helping the sliding during the whole industrial operation and for helping to improve the appearance of the packs.

As for tinplate, the coatings are made of resins which must be in conformity with the national laws. In case of easy opening lids, certain coatings are now made with plastics films.

The remark concerning the varnished tinplate boxes can be applied for varnished aluminium boxes which, in certain cases, alter the colour and sometimes even the taste of goods (peas, peaches, asparagus). For avoiding these drawbacks, the quantity of air in the boxes is reduced to the minimum.

. Use of these boxes

- For products with a Ph above 5.8, one varnish coating is sufficient (meat, meat pies, fish in oil or natural, peas and spinach)

- For products with a Ph under 5.8, it is necessary to use embossed boxes presenting two coatings and lids protected with a plastics film.
- For pasteurized products which are filled at a temperature below 100°C, the types of boxes used are coated with vinyllic organosol or varnishes. The easy opening lids must be treated in the same way. Such boxes are used for fruit juices, marmalades, concentrated tomatoes, fruit in sirup or natural.

4.- COMPOSITE BOXES (ALU/TINPLATE)

Generally, these boxes have the body or body and bottom made of tinfoil and the lid or lid and bottom made of aluminium.

For these boxes, it is compulsory to check the pack for every type of goods. They are used for certain fruit juices, carbonated beverages, dry products such as nuts.

Regulations for European market for transportation, distribution, commercialization and hygiene point of view.

Practically no precise requirements exist for transportation, commercialization and hygiene.

However, certain habits, which seem to be nearly taken as rules, are followed for weight and size of containers.

In the Common Market, commissions of experts are still dealing with this matter.

It is perhaps possible to say that the future requirements will not cover the important part of the packs concerning 1, 2 or 3 kg. But the outer packages for a certain number of small units will be certainly defined in size.

It appears difficult to say that rules or requirements would rapidly prescribe such or such quality of compression.

Finally, however, it is these qualities which must be defined because :

- they seem necessary
- it is possible to think they will be prescribe in the future.

In the time being, citrus fruits are received in bulk (corrugated board or wooden outer packages) for 20 kg or in units.

In case of units of 2 - 3 or 5 kg for instance, these last ones are :

- in bulk in a large container or waggon
- in box-pallet
- in corrugated board or wooden outer packages

Our knowledge in the matter confirms that a lot of drawbacks appeared in the past with agricultural goods exported in Europe specially because their packs were not sufficient or too irregular.

Distribution

The influence of Hypermarkets enforces palletization which seems more and more important for avoiding too many handlings.

Generally speaking, before arriving in linears, where the customer chooses the goods, all products come in a central point and in fact, the preference is given to products which are palletized. These pallets may be delivered in complete units or the load may be divided according to the demand.

When the load on pallet is shrinkfilmed or stretchfilmed, it represents a certain interest for handling because all outers can be seen.

There is no rule concerning imbrication of outers on pallets. Every firm takes the responsibility of the arrangement and gives instructions for having the best imbrication.

In a short inquiry, we have been told that, very often, products coming from Arab countries are arriving in bulk in large containers. In this case, several supplementary handlings are necessary, increasing the final price simply because salaries of workmen are higher in Europe.

It appears that a common way consists, at the arrival, in taking out outers from large containers in order to build pallets because it is the only way of transport considered as acceptable for the distribution.

Concerning the pallets currently used, we can say for France that the size 1000 x 1200 mm represents 40 % of the market and the size 800 x 1200 mm 30 %. The trend for the future is as follows concerning the materials used :

- 80 % wooden pallets
- 5 % pallets made of plastics
- 15 % pallets made of other materials

Nevertheless, it is too early to say what type of pallet will be obligatory in the future, but a decision will be certainly taken.

Hygiene point of view

We don't know special rules concerning this problem except those which concern the components of packs coming into contact with foodstuffs. We must say that these last ones are particularly strict for liquids.

Commercialization

Generally speaking, it is of course necessary to mention very clearly on the packs :

- the net weight
- the country where the goods are produced
- the definition of the goods themselves
- components of the product specially in case this last one includes several additives.

Point 4

Marketing problems which should be included in the activity of the Regional Packaging Centre.

Before helping the Regional Packaging Centre about Marketing problems which should be included in its activity, it is necessary to precisely know the Marketing problems met for the sale of exported goods in Europe.

The packs represent only one part of the problem, and except for certain cases, perhaps very important, they do not, generally, represent the most important one. That means that, as everywhere, the Marketing aspect of the packs should be considered only after knowing the general Marketing policy for the goods themselves.

- It would be interesting to set up in the Regional Centre a Marketing section the work of which being :
 - . to inform salesmen about all possibilities in the type of packaging concerned before taking their sales contacts.
 - . In order to give these people this knowledge, the specialist of the Centre should be in a position to sum up the characteristics of the packs they propose for such or such type of goods.
 - . The specialist of the Marketing section should be in a position to indicate not only an approximative price of the considered packs but also the trends in price for the same components.

In case the packs are defined by the customer - that is always possible specially for a matter of storage, - the specialist of the Centre should be able to confirm if it is possible or not to meet the demand.

In case, after examination, it would appear to the specialist that an Arab country cannot confirm the possibility of producing the type of packs wished, he must be able to propose another version, giving to the salesmen sufficient arguments for helping them to solve their sales problems.

-In order to really help the Marketing or the salesmen:

- . Experts of this Marketing section should first completely know the present situation of all packs generally used in Europe for the considered product.
- . The knowledge must be actualized specially from a Marketing point of view.
 - About prices of raw materials, they must know how the situation is in the main European countries and if possible, they should understand why such prices are moving that is to say they should know the several policies involved.
 - About the prices of materials, that is to say investments, the situation is still more delicate because a lot of new mechanical possibilities appears every year and it is really very difficult to give good comments about their efficiency.
 - These experts should evidently have a good idea concerning the evolution of the Marketing trends.
 - It is necessary not to forget that even in European nations and specially in the Common Market, no rule is really available for giving a good picture of the market trends.

- Experts should do the necessary in order to know the general Marketing aspect of the packs practically every year.

In Europe, the general evolution of the processes is so important and differences in prices are so determinant that it is rare not to see novelties during a year. These last ones are not always very good. Sometimes they have the only advantage to be new and the experiment shows that this argument is not always sufficient.

- For giving an example, one of the most important question is to really know whether goods are to be delivered in bulk or in ready to be bought units or in both possibilities.

A very short inquiry seems to indicate that small unit packs or sometimes promotional arrangements could be asked, giving, in a lot of cases, an important added value for Arab countries.

In any case, it must be considered that a lot of efforts should be made for solving the problems of storage and palletization.

To sum up this point :

- People from Marketing section must be ready, after reporting from the salesmen, if necessary, to help them with their advice for finding the best solution (economical point of view).

- However, the fact that salesmen could lose too much time in consulting the Regional Packaging Centre, means that it is, perhaps, necessary to foresee representative people of a Marketing section in the National Packaging Centre (one per country or per group of countries).

Experts for this Marketing section should work in close contact with the Marketing section of the Regional Packaging Centre.

All these experts must be Marketing minded and those belonging to the Regional Centre should provide all available information to their colleagues.

- Of course, Marketing people should be aware of all information concerning the indications to be written on the pack according to the country the goods are sent to :

- Definition of the goods
- Net weight
- Indications of all components in case there are some added
- Place of packaging
- and so on...

As far as we know, it seems that no special regulation exists for the moment, but the complex work of experts in the Common Market's commissions may change the situation in the future.

Point 5

- 15 -

Consultation services in the Regional Centre covering points 1 - 4 mentioned above for National Packaging Committees

To know all the basic problems of the modern packaging industry and its evolving for an expert or a group of experts needs a lot of time and money and specially a lot of excellent contacts.

For these reasons, we think that one Regional Centre should be sufficient for giving help and assistance to National Packaging Committees.

In our opinion, everything begins with the organization of a Regional Centre. If it is in a position to carefully follow the packaging matter in general, it should be then able to discuss and find quickly a suitable answer to the request coming from National Packaging Committees.

Gathering all information concerning the packaging problems and having obligatorily in their files a lot of examples, technicians of the Regional Centre should be able to help to assure the best choice.

The interest would be more important if these experts were able to give the specification sheets for raw materials or packs involved.

For the Marketing Services already seen in point 4, it appears easy enough to find a solution but when the quality of the packs to be used before exportation has to be tested, a difficulty occurs because it appears impossible to ask every time the Regional Centre for such an action, this Centre being only foreseen as a central point for giving the important lines of a packaging policy.

On one hand, controls are certainly very important and sometimes, even now, the lack of controls for certain Arab packs is given as a drawback by European customers and on the other hand, it appears practically impossible for a question of investments to really ask for a complete National Centre everywhere. For solving this problem, 2 or 3 centres should be foreseen and fitted with the apparatus needed for testing types of packs generally used in 2 or 3 countries.

Practically, even in case National Centres are judged necessary almost everywhere, it would be interesting to determine the places where some of these centres should be more equipped being then considered as relays.

To sum up this point, the Regional Packaging Centre will help the National Centre to ensure :

- the advice concerning the necessary control apparatus
- the training of the national experts
- the divulgation of the packaging technology
- and indicate the main rules to be followed in order to be Marketing minded.

Several smaller Regional Centres could cover 2 or 3 countries giving to these last ones their help for controlling the quality of the packs used before exportation.

but

The Regional Packaging Centre must act as an expert at the National Centres' request.

International Regulations and rules setting out responsibilities in case of damage caused by handling and transportation. Technical regulations (requirements).

A short enquiry seems to indicate that no requirements exists allowing to set out responsibilities in case of damage during handling and transportation.

Generally speaking, industrial people export on C.I.F. or F.O.B.

- C.I.F. : It is the way strongly recommended for the buyers because the insurance covers all the risks of handling and transportation, that means that the producer of goods must take all precautions for packing his production.
Usually, for large machineries, the manufacturer asks a firm specialized in industrial packaging matter, for protecting them. It is quite the same way for the transportation which includes several handlings : the producer chooses a firm which represents for him a security.
If a damage occurs, the producer is completely responsible and it is then up to him to try to prove, with the help of experts, that all precautions have not been taken during the packaging operation or for the stowage.
As it is quite impossible to define rules setting out responsibilities (how is it possible to determine if a pack is good or not), the international regulations say that the insurance does not cover the risk of inadequate or bad packaging (to be understood in the wide sense of the word).
- F.O.B. : In that case, the producer guarantees his goods only till the board and the buyer has to choose insurance and transportation.
Practically, the buyer has a security less important, but he generally takes this way for a question of final price.
In case of damage caused by handling or stowage, he has to negotiate with the carrier, with the help of an expert.
If he thinks that damage is due to the pack, he has to prove, always with the help of an expert, the bad quality of the pack.

To sum up :

- present European regulations seem not to cover rules setting out responsibilities in case of damage caused by insufficient or bad pack.
- It appears impossible to give a good definition of a satisfactory pack.
- Only specialized firms dealing with special industrial packaging seem able to represent a guarantee.
- The best solution appears to buy something in C.I.F. position.

Necessary unified testing methods which should be elaborated by Regional Centre for all Arab countries.

The unified testing methods are absolutely necessary to be sure of the quality of the raw materials and packs used. Even in Europe, a lot of time was spent for determining unified testing methods and it can be said that even now, certain points are not quite clear.

However, 3 great lines should be foreseen in any case :

1.- Taking into account the fact that corrugated board, treated or not, should represent the most important raw material used, it is necessary to have, in one or several central points, large conditioning chambers allowing the use of the following apparatus :

- revolving drum for tumbling test
- jarring tables
- shock tester
- compression machine
- dynamometer
- perforation recorder
- bursting tester
- penetration measurer
- stiffness meter (rigidimeter)
- porosimeter
- pH - meter
- climatic containers
- checkweigher

The necessity of having this type of chambers must be underlined, or at least, some climatic containers for the very beginning have to be foreseen. Without this type of plant, it would be impossible to guarantee the validity of the packs and impossible too to determine the good choice between several qualities.

It must be known that, even now in Europe, a lot of drawbacks appears because firms, sometimes even important ones, have decided not to follow that way.

2.- In case plastics units are directly sent to Europe, it would be necessary too to control the quality, but in that case, it is much easier. The compression machine and the revolving drum for tumbling test seem sufficient. Concerning the possible migration of monomers, it doesnot seem necessary to have everywhere and perhaps even in the Regional Centre special laboratories. The measurements really require specialists and only certain European laboratories seem available for this type of analysis.

It is always possible to ask the raw material supplier himself for analysis but if this way is sometimes sufficient and certainly the cheapest one, it is much better to have results established by a very wellknown independent laboratory.

It might be interesting to know that, even in Europe, a lot of important firms found this way as the best one.

3.- Concerning the tins, up till now as it has been seen in point 2, no requirement has to be followed except for the control of the varnishes which must be in conformity with the national law and, in the future, with the Common Market requirements.

The problem of corrosion is certainly the most urgent one and a laboratory should be foreseen at the Regional Centre for studying all these problems. This laboratory should be able too to find the percentage of arsenic or lead in order to be in conformity with the future European rules.

Techniques applied for packaging and agricultural products which are stacked in cooling-rooms.

More and more, for avoiding troubles, citrus fruits and other agricultural products are transported by boat in cooling-rooms. Arriving in a harbour, the containers are also placed in cooling-rooms.

However, in Europe, all the systems of distribution and commercialization are still not equipped with these cooling-rooms.

It is thought that certain drawbacks happening on packs were due to an inadequate strength after storage in cooling-rooms. Some precisions must be given here because cooling-rooms in themselves are not totally responsible for damage.

- Humidity ratio in cooling-rooms

It has been stated that in cooling-rooms, 1 kg dry air contains 0.004 kg water in case of 95 % relative humidity at 2°C.

At 20°C with a relative humidity of 65 %, that is to say practically at a normal European temperature, 1 kg dry air contains 0.010 kg water.

It can be seen that cooling-rooms donot have a higher humidity ratio than for a storage at normal atmosphere.

- Atmosphere in cooling rooms

The atmosphere in cooling-rooms is not so wet as usual. Therefore the cooling room cannot be responsible for an increase of humidity of the stored outer packages made of cardboard.

Two facts are to be taken in account : on one hand, the moisture coming from fruits and vegetables and the transfer of humidity from inside to outside, and on the other hand the condensation due to the temperature difference between the inside of the packs and the cooling-room.

It is generally admitted that the humidity increase for outers is of 3.5 %. The storage in cooling-rooms increases this ratio of 1.5 % giving a general humidity increase of about 5 %. If the percentage seems, at first sight very low, it is admitted that the corrugated board has lost 30 % of its compression strength.

- How to protect corrugated board ?

Lots of trials have proved that an hot-melt coating gives a certain barrier against the humidity transfer.

. When the coating is applied on the internal side, the increase of humidity is reduced from 5 to 4 %. In that case, the corrugated board loses only 25 % of its compression strength instead of 30 %.

. If the coating is applied on the outside, the corrugated board increases its humidity ratio up to 9 %, losing then more than 50 % of its strength characteristics.

- Influence of storage duration on cardboard

It has been proved that cardboard which bears a load during a certain time loses a part of its characteristics. For instance, an outer which must be sufficient for taking an 100 kg load must be calculated at 170 for maintaining good results after one month storage and at 200 for 9 month storage.

For a load of 400 kg, the outer should be calculated at 690 for one month storage and at 800 for 9 month storage.

In these two examples, a coefficient of 1.4 for normal corrugated board and 1.3 for treated corrugated board must be assigned, both for storage in cooling-rooms.

- How the problem of a better compression strength is generally solved for storage in cooling-rooms ?

- . All treatments mentioned in point 1 for corrugated board containers begin to be used and it has been seen that they improve compression strength after storage in cooling-rooms. Unhappily, the different treatments cost a lot of money and it is mainly this point which reduces their use. At present, certain firms begin to produce outer packages made of corrugated board treated with a certain percentage of Escorez types according to a new process. These outers have the particularity of keeping a good compression strength after storage in a very high humidity climate.
- . Concerning these treatments, it is however possible that a large use begins in the future according to the decrease of the ingredients and to a new possibility of real industrial treatment.

The best solution used practically in a lot of countries for keeping sufficient characteristics after storage in cooling-rooms, consists mainly in increasing the paper quality and its weight in order to obtain the sufficient compression strength after the loss due to humidity. For fruits or vegetables coming from South America, North America, Australia, outers are generally untreated but are made of very high quality board.

According to the agricultural goods, a lot of possibilities exists concerning the paper sheets or the plastics foils used inside wooden or other containers. No rule exists for defining them but it seems logical to admit that dividers permit to raise the compression strength and in certain cases only, the dividers are treated according to the processes described in point 1. A solution giving also a better security against a loss of compression strength would be to use dividers in expanded polystyrene which keeps completely its compression strength in all humidity ratios.

Point 9

Testing methods for packaging of industrial products imported from developed countries, from Quality Control point of view which allows to prove damages caused by insufficient packaging during transport and handling.

It has been seen in term of reference 6 that there is no rule for setting out responsibility in case of damage caused by insufficient packaging.

It is asked if some testing methods could prove that a pack is bad, but it is not necessary for the buyer of industrial products to know the testing methods because, when a damage occurs, only the producer of the industrial goods is responsible.

The task of the buyer is to protect himself against damage in having a well done contract with special clauses. For instance, he should stipulate that the industrial products, especially machineries, should be delivered, set up in the factory and ready to run.

If he has some doubts on the quality of the packaging of machines or on the machines themselves, the buyer should not touch them but call for an assembler coming from the producing firm. He has to contact the customs broker who will do the necessary for registering reserves on the goods delivered.

The producer of industrial goods, in case of articles of small dimensions, will be able to test the packed goods in a transportation simulator. Generally, this method is applied only for goods which are produced in series or for moulds.

For large units, the producer currently has the habit to pack his production himself and in that case, the work is done in the factory with specialists belonging to the firm.

In order to prove that the packaging of a producer has satisfactory characteristics for the protection of goods, some organizations have tried to set up methods of analysis.

Their aim was to be able to deliver to the producer a packaging guarantee certificate for insurances.

Finally, as far as we know, after about 10 trials, the results were not good enough because these organizations took only in consideration the specifications of raw materials used.

We have been told that the insurance firms continue to be in favor of such a certificate which seems to represent for them the beginning of a security.



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