

Fresh fruit vending machines *in school establishments*

Within the framework of the National Health Nutrition Program (NHPN), the Health Ministry wishes to encourage the consumption of fresh fruit and vegetables by teenagers. Is selling them in the school environment via vending machines achievable or is it an impossible ideal? Throughout 2003, two Bergerac (24) high schools acted as the base experiment for this project. The CTIFL was in charge of researching the technical aspects as well as determining the expectations of this young, captive market. This has been voluntarily left in a competitive context. No communication action was carried out.



The present vending machines: *four strong advantages in a competitive world*

For them, these vending machines offer complete ease of use, absolute availability, are operational outside of the limitations of the canteen and purchases external to the establishment, and access to the product is without intermediaries, judgment or criticism : a choice that is 100% practical, enabling easy consumption. The fruit is transportable, divisible and can vary. It is a highly marketed offer: the vending machines have a great reputation. The students said they were prepared to try out this original offer at least once, out of curiosity. Despite being transportable, it was strongly criticized. Thus their link with their young customers is only a marketing one. The existing equipment, which happens to be unattractive and unfamiliar, is called into question. The choice was unanimously qualified as being expensive, incomplete, rigid and "nutritionaly poor" - too calorific while lacking nourishment. The prices, which range between 0.30 and 1.50 , are justified, according to the two groups, by the

presence of leading brands. Presently holding a monopoly, these snack products satisfy the needs of a captive and hungry target market. (the main reason given for buying the products).

Yes to an alternative offer

The fresh fruit vending machines were favorably received by the teenagers. They seem to be an attractive diversion. The high school students said they were prepared to try this original offer at least once, out of curiosity. Faced with competition that is already highly implanted and very attractive, they need to be convinced. The impact of word of mouth in this closed world will do the rest. Among the disadvantages of the fresh fruit offer observed by these young consumers, we note uncertainty about tastiness and the impracticality of "generic" or worse, unknown products, culturally ill-associated to the business sphere. For the young people, variety is one of the successful elements of these

vending machines. The assortment offered would necessitate going beyond the classic fruits known as “canteen fruits”: apples, bananas and oranges. What’s more, to be qualitative, the students would like a wide range, regularly updated. The objectives - a better knowledge of fruit and even some vegetables, variable reputation, reintroduction of seasonal products, education about taste and nutritional qualities, and discovery of new products - are feasible. At this stage in the study, there is genuine anxiety about the freshness of the products and numerous questions about restocking, which must be visible, regular and often. Young people demand that all the fruit to eat is washed and, in the case of the most fragile, packaged. To them, if pre-packaging is synonymous with protection, it facilitates transport and guarantees hygiene, as well as increasing costs, » packaging pollutes”. Prices compulsorily aligned with those practices through competition will never exceed one euro. The life of the products and constraints of restocking do not justify paying trade prices to these customers. The world of fruit seems out of touch with a business approach – this is even truer since the experiment is done in rural areas. See marketing.

The fruit vending machines *aroused curiosity and were popular*

High school students were sensitive to the vending machine’s appearance. They thought the presentation of the fruit was appropriate and practical. The choice was clearly visible, as well as the interior of the machine which looked clear and clean. Narrower than the classic vending machines, the equipment implied slimness and few calories. The blue color was not one that is normally associated with the world of food and fruit in particular. It did however evoke freshness with an appearance “like a big refrigerator”. On the other hand, they thought the machine was not decorative enough. The teenagers understood the operation very well: The fruit vending machines were placed next to the regular machines in a traffic area, shown to be a suitable location. The students did not nickname the new item of equipment, which remained, rather prosaically, the “fruit vending machine”. As with the other machines, there was no approval. The labels are barely read or not at all, out of lack of time or interest. The students looked at the fruit, assessed it, and then purchased it without feeling the need to look at the label. The shortest names of the varieties were best remembered. Only the prices were known as a matter of course and (relatively) attributed to each item of fruit. The high school pupils read the label from the wholesaler giving the price in kilos, which to them was still the ultimate arbitration criterion. Some carried out comparisons with the wholesale prices. The definitive choice was made in front of the machine,

according to the fruit available. Purchases were also quite lengthy compared to those done at other vending machines. With the latter, the teenagers know by heart the number corresponding to their preferred candy. The “fruit” reflex is still to be created. According to the groups, their “overall” weekly vending machine budget has still not evolved. If the fruit vending machine took some of the regular vending machine custom, the price also made a difference. With the same amount of money, young consumers could buy more fruit than sweets. With regards to the assortment, the range of apples was thought to be too high (four trays out of ten during the test period). 4th range products (such as small fruit salads), or even dried fruit, would have been welcome. Putting two small apples of different varieties rather than one large piece of fruit could encourage students to taste other varieties, to get to know and recognize them, to share their purchases and vary their consumption, still at only 1 maximum for each item of fruit! Restocking was satisfactory. Overall, their opinion was favorable and the final word positive: “It should continue!”

Customer loyalty gained *over the regular vending machines*

Out of the 234 students who returned the second questionnaire, we count three buyers out of four. They unanimously acknowledge the tasty quality and variety of the fruit. Development in terms of choice was perceived by two thirds of buyers, which is far from the case with regards to the prices (increase attempt with the addition of a napkin, variation in the increase in the wholesale price of cherry tomatoes). 40 % of the teenagers did not notice this increase and 20 % could not answer. Consumption occurred immediately after purchase. Purchases were mainly shared between them (67 %). Another positive result was customer loyalty. 82 % of teenagers said they “had purchased more than once”. Elsewhere, as the groups of young people show, it is a matter of transferring from their usual machines. Actually, 60 % of buyers said they had used the other vending machines for drinks more often than for sweets. With a probability threshold of 95 %, in the worst case one buyer in two was won over by the fruit vending machine. The labels are rarely read (40 %) and, as might have been expected, two thirds of this customer base disagrees with the comment “the fruit is fairly priced”. In general, what has been the impact of the installation of fresh fruit vending machines? To the question “Since the installation of the vending machine, do you pay more attention to your consumption of fruit and vegetables?” a third of buyers said yes, 69 % had discussed it between themselves and 95 % want the experience to continue.

The different types of vending machines devoted to fruit

The fragility of fruit and vegetable requires the use of equipment which preserves the distinctive integrity of the products and therefore ensures that the distribution of the product goes smoothly.

The choice is focused on revolving vending machine equipment (with stainless steel rotating trays). There are two main types:

The "Shopper" system.

The consumer can choose the desired item of fruit, turning the rotary until they reach the selected fruit with the help of a push button. There are ten to twelve trays, each comprised of twelve or more compartments that are adjustable in width.

■ Advantages

Thanks to the Shopper system, the consumer can choose the desired product and the variable appearance of each item of fruit (fruit that is somewhat large or colored) should not affect their choice. The choice criteria are therefore wider, so the average appearance of each item of fruit doesn't matter so much.

■ Drawbacks

This process entails a longer waiting time in front of the machine as the consumers take their time to choose their product, which may reduce the level of sales.

Management of restocking is more difficult as it is impossible to know the date the products were put in the vending machine without looking at individual labels on the dishes.

In addition, with this process the vending machine may show an empty side and mislead the consumer.

"FIFO" System (first in, first out)

The consumer takes the first fruit which arrives in front of the barrier. There are ten to twelve trays, each one comprised of twelve or more compartments adjustable in width.

■ Advantages

The FIFO system does not have the drawbacks of the Shopper system, where the consumer is obliged to take the first fruit that appears. Thus management of restocking is easier, since the date the products were put in the vending machine is known.

■ Drawbacks

An item of fruit with an average appearance may block the sale of the whole tray and necessitates the need for impec-

cable products. Moreover, programming of the equipment after restocking is rather laborious.

Characteristics common to the two systems

At the level of internal temperature of the vending machines, there is an average gap of 2 °C between the top and the bottom of the machine. The FIFO system is, nevertheless, more heterogeneous per level. The hygrometry inside the machines is connected to warm air. A system for regulating the humidity levels is currently being developed in order to reduce drying of the products.

With both systems, cleaning the vending machines is a long and tedious process.

Regulation and management of the machines

To supply a quality product to the consumer, the temperature and hygrometry conditions inside the machine must be well-managed.

A temperature of 9 to 10°C corresponds to optimal for consumption.

To manage the temperature and the hygrometry, autonomous probes can be placed in strategic places inside the machine. The studies carried out by the CTIFL in the high schools in Bergerac and the CTIFL of Rungis have enabled us to determine the average take of a certain number of products in the fruit vending machines, summarized in [TABLE 1](#).

TABLE 1-Display of fruit in the vending machine

Vending machine height
Fruits requiring low temperatures
Strawberries
Fruits producing ethylene
Apples, pears, apricots
Fruits without particular thermal requirements
Clementines, prunes, dried apricots, grapes
Fruits sensitive to low temperatures
Bananas, cherry tomatoes, kiwis
Vending machine base

Packaging and washing

In order to increase the value of the products inside the vending machine and to avoid getting them dirty, different types of packaging are envisaged:

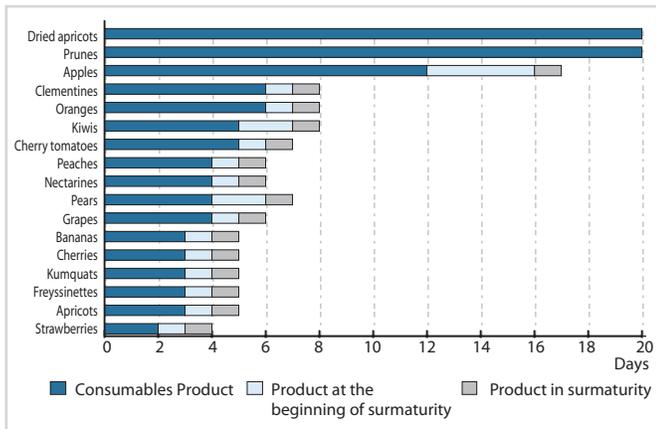
- plastic containers for items of fruit sold individually. This avoids the “balloting” of the fruit during equipment rotations;
 - plastic punnets for packaging products:
 - which are sensitive to dehydration (grapes, apricots);
 - which are sold as a consumer unit (strawberries);
 - which require accessories (a spoon, a napkin).
- A napkin could be provided with “juicy” products for more convenient consumption
- Perforated plastic sachets for products sensitive to dehydration (bananas).

Products which can be eaten as they are without being peeled are washed for immediate consumption. With strawberries, we will provide a pictogram advising consumers to rinse the fruit in water before consumption.

Evaluation of the life of the product

The studies carried out by the CTIFL in the high schools in Bergerac and the CTIFL of Rungis have enabled us to determine the average quality of a certain number of products in the fruit vending machines, summarized in **FIGURE 1**.

FIGURE 1-Average life of an item of fruit in the vending machine (in days)



Adaptation of fruit to the vending machine

Recommendations in terms of possible choice of fruit to put in the vending machine follow on from **FIGURE 1**. The choice should be made in accordance with the ability to easily restock each item

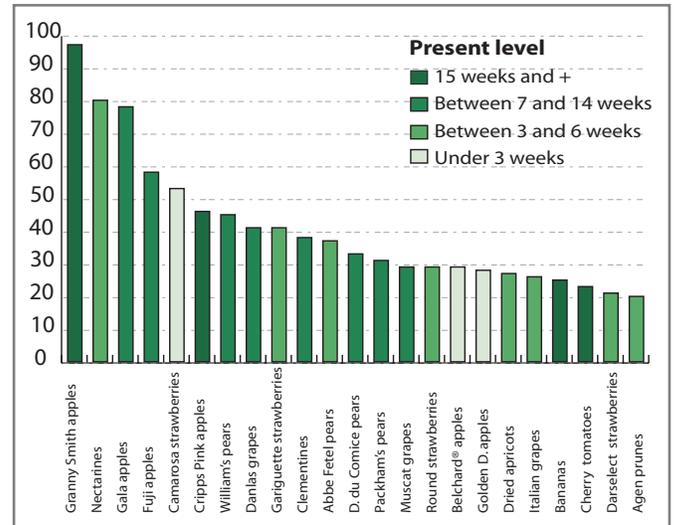
TABLE 2 -Adaptation of fruit to the vending machine

Adapted to the vm with maturity constraints	Adapted to the vm with rotation	Adapted to the vm with constraints
Dried apricots	Kiwis	Bananas
Prunes		
Apples	Pears	Cherries
Grapes	Nectarines	Strawberries
Clementines	Peaches	Kumquats
Oranges	Apricots	Freyssinettes
Cherry tomatoes		

Assessment of purchases

FIGURE 2 accrues the average product purchases per week in the two vending machines in the two Bergerac high schools (from February to end of June 2003 and September to December 2003). Accumulated purchases lower than twenty items of fruit per week are not mentioned.

FIGURE 2 –Purchases in numbers of items of fruit per week in the two vending machines



Profitability factors

of the automatic vending machine in the school environment

This simulation takes into account data from the experiment carried out in Bergerac in Spring 2003. The calculation of the margins, fixed and variable costs is actual data, collected during the test in the two Bergerac high schools (**TABLE 3**).

TABLE 3-Return cost calculation and margin of the products tested (in euros)

Product	Return cost calculation (1)	Sale price (2)	Margin (2-1)
Apples	0,23	0,4	0,17
Pears	0,26	0,4	0,14
Oranges	0,16	0,4	0,24
Clementines	0,29	0,3	0,01
Kiwis	0,22	0,5	0,28
Grapes	0,23	0,6	0,37
Tomatoes	0,37	0,7	0,33

For an average margin equal to 0.24 €

Capacity of the machine and frequency of restocking

The automatic vending machine has ten trays with twelve products each.

For weekly restocking, the maximum of products sold per day is $120/4.5 = 26$ fruits.

For bi-weekly restocking, more reasonable due to the life of some fruits (pears, kiwis, grapes, tomatoes), we exceed 52 units per day.

Calendar for loading of the vending machine

	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.
Apples										
Pears										
Oranges										
Clementines										
Kiwis										
Grapes										
Tomatoes										

Calculations based on 190 days for ten months of business

Profitability factors

We may, by modifying the average sale price of the fruit, define the sequential profitability threshold of the automatic vending machine depending on product units sold and years.

Taking an average sale price of 0.6 , as a second possibility, return on investment is obtained at best in the fourth year of operation.

With the third possibility; an average sale price of 0.8 , return on investment is obtained at best in the second year of operation.