

MRLs AND PESTICIDE RESIDUE CONTROL IN THE SWISS MARKET OF FRUITS AND VEGETABLES

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INTRODUCTION

In Switzerland there is a total of 20 Governmental Laboratories that are responsible for food control. These laboratories are managed by the "26 Cantons". Some of the small neighbouring Cantons joined to run a common laboratory.

The "Federal Office for Health (BAG)", which is part of the "Swiss Department of the Interior", supervises the execution of food law through the Cantons and coordinates actions of national interests. The maximum residue limits (MRLs) for pesticides are set by an expert committee of pesticide residues by order of the BAG.

The purpose of this contribution is to give an insight in the Swiss Food Legislation, which was renewed in June 1995, emphasizing the regulations of pesticide residues. Additionally there is an overview over the control of pesticide residues in fruit and vegetables in Switzerland covering sampling instructions and programs, execution of the law by the authorities, analysis and results of concerted actions.

THE STRUCTURE OF THE SWISS FOOD LAW

Law relating to Food (SR 817.0)

Principles

The principles of this law are the following [Art. 1]:

1. Protection of consumers from health hazards through food and consumer products.
2. To assure a hygienical way how to deal with food.
3. Protection of consumers from fraud concerning the foodstuffs.

Point 1 is for example aiming to a Good Manufacturing Practice in agricultural production, resulting in crops that do not contain toxic concentrations of pesticide residues. Subsumized in point 3 are the biologically grown products, which are supposed to have no measurable pesticide residues. Products that are declared as biologically grown and show measurable pesticide residues are therefore rejected even when the concentration of the pesticide is below the MRL.

Furthermore the above mentioned law defines foreign substances as substances that are undesirable and do not occur naturally in food (such as pesticide residues, contaminants, mycotoxins and radionuclids) [Art. 4³].

Remarkable Reforms

An essential reform of this law is the principle of self control. Every company that produces, trades, sells, imports or exports food or foodstuff has to care for products that meet all the legal provisions. To assure this, the company has to analyse the food itself or has to engage a laboratory with the analysis [Art. 23].

Costs of official analysis: If an official control by a cantonal laboratory results in an objection, the costs of the analysis have to be paid by the owner of the commodity [Art. 45].

Ordinance on Food (SR 817.02)

This ordinance implies several definitions and regulations of general concerns for all food items as well as specific regulations for individual food items or food categories.

Ordinance on Foreign Substances and Ingredients in Food (SR 817.021.23)

This ordinance is based on the “Ordinance of Foodstuffs [Art. 7, 9² und 16³]” and contains six lists. The MRLs for pesticides are in list 1. List 2 to list 6 include the limits for “metals”, “residues of veterinary drugs”, “other foreign substances and ingredients (such as nitrate)”, “mycotoxins’ and “radionuclids”.

MRLs

There can be two MRLs for one substance in the same foodstuff. A literal translation of these two limits is “Tolerance Value” and “Limiting Value”. The definitions of these terms are as follows:

- Tolerance Value: the limit where a foodstuff is recognized as of minor quality but not as harmful (mostly the Good Manufacturing Practice was not that good, resulting in an elevated concentration of the applied pesticides in the crop!).
- Limiting Value: the limit where a foodstuff is recognized as a health hazard and as not suitable for human nutrition.

Fixing the MRLs by an Expert Committee of the BAG

The members of this committee are toxicologists, agronomists, nutrition chemists and environmental chemists.

Art. 3 of the above ordinance shows the criterias upon to fix the MRLs:

- a) toxicity of the compound.
- b) technically unavoidable concentration of the compound in the foodstuff.
- c) uptake of the compound on the basis of an average daily intake calculation of the concerning foodstuff.
- d) additiv effects of compounds which are supposed to target the same biological systems in the human organism.

If there is a MRL in EU for a certain compound it will be adopted by the Swiss Legislation as well.

Principle of List 1

More than 300 compounds are listed with the corresponding MRLs in different foodstuffs. It is a “positive listing” meaning that all pesticides that are not mentioned are prohibited and that all the foodstuffs that do not have a distinct MRL or are not to classify under a referred food category are supposed to be free of this pesticide.

An annotation to the list contains a description of the products or parts of products to which the MRLs are applicable. This description is in its contents similar to the EU guideline 90/642/EWG.

In case of doubt the BAG has to decide which MRL is applicable considering the main principle that ‘foreign substances and ingredients should only be present in concentrations that are harmless and technically unavoidable’ due to the above mentioned ordinance [Art. 1].

EXECUTION OF THE LAW

If a product shows pesticide residues above the Swiss MRLs the “Cantonal Laboratory” prescribes how to deal with the rejected commodity. Compliance sampling in these cases is organized by the “Cantonal Laboratory”. According to the different existing limits in Switzerland typical prescriptions could be:

Residue above the “tolerance value”:

Instruction to clarify the reason that led to the elevated concentration of the pesticide as well as writing down the precautions that are met to prevent a repetition of the objection on behalf of the authority. The bill for the analysis has to be paid by the owner of the commodity. A repetition will result in reporting to court.

Residue above the “limiting value”:

The commodity is not suitable for human nutrition and has therefore to be destroyed (the rest of it!). An instruction will imply that the owner of the commodity is allowed to sell further lots from the same producer or importer only if he shows through certificates of analysis that the product meets all the demands of Swiss Law. The bill for the analysis has to be paid by the owner of the commodity. In severe cases a sudden reporting to court will be implemented.

SAMPLING

Procedure

The size of the sample is according to the size of the whole commodity. The demands for sampling are described in section 1.3 of chapter 46 of the swiss food book (SLMB).

The sub-samples have to be taken statistically over the whole lot. A minimum number of sub-samples and a minimum total amount are required. These numbers are 10 (or a total of $\geq 1\text{kg}$) for products with a weight between 25 to 250g and 5 (or $\geq 2\text{kg}$) for products over 250g. For products with an individual weight below 25g a total of 1kg is required for analysis.

The sampling is done by the representatives of the laboratories that are responsible for the analysis.

Program

There is no national sampling program for pesticides except if there is a need for monitoring the residue situation for a certain substance or a certain product. In these cases the BAG coordinates the action of the 20 laboratories.

The cantonal laboratories determine their own sampling programs, however not all of these laboratories are able to do pesticide residue analysis. As a rule they take samples from the producers within their geographical borderline to cover the domestic production and from the stocks of the distributing centers of the big warehouses to cover import products. In certain cases sampling takes place at the customs duty.

Of course sampling is made on the basis of spot-testing, leading to a total of 3225 import samples and 4720 domestic samples that were subject to pesticide residue analysis in the year 1994.

Some of the cantonal laboratories carry out concerted actions such as the control of winter salads (lettuce, lollo, lamb's lettuce (rampion)). Results of this action are shown later in this paper.

ANALYSIS

There is no reference multi-method by which all the laboratories perform the pesticide residue control. However, chapter 46 of the "Swiss Food Book" offers a collection of analytical methods that serves as a guide for the pest-laboratories.

The mainly used extraction (partition) systems for plant materials are acetone/dichloromethane or ethylacetate. A cleanup if necessary is done by gel chromatography on Bio-Beads SX-3. Determination is performed on selective detectors such as ECD, NPD or FPD after capillary gas chromatography - depending on the pesticides to be quantified. Confirmation is usually done by chromatography on different columns and detectors and GC-MS. For the determination of dithiocarbamates, inorganic bromide, and other specific pesticide residues individual methods are used.

The methods used have to be tested according to the requirements of the accreditation label EN45001. This results in monitoring of the quality of all the used pesticide methods. Interlaboratory test program samples as well as internal control samples are analysed frequently for this purpose. Though not all of the cantonal laboratories are accredited yet, the most of them will be in 1 or 2 years.

RESULTS & DISCUSSION

Concerted Actions of Cantonal Laboratories: an Example

Salad vegetables in winter: a survey of the nitrate content and the residues of pesticides and bromide [Mitt. Gebiete Lebensm. Hyg. 86, 497-511 (1995)]

In the winter months from November 1991 until January 1995, five cantonal laboratories of Northwestern Switzerland carried out extensive control of garden lettuce, lollo and lamb's lettuce (rampion). These commodities are grown under conditions that are far away from being ideal:

- less sunshine leads to elevated nitrate contents in lettuce;
- heating of glass houses leads to high moisture favoring molds growing, though resulting in application of more fungicides.

In total 476 garden lettuce, 240 lollo and 355 rampion samples of domestic and foreign production were subject to analysis. The main problems were the elevated nitrate contents in Swiss garden lettuce and rampion as well as the pesticide and bromide residues in commodities of French and Italian origin. The percentage of rejections is summarized in Figure 1.

Summary of the Pesticide Residue Control in Switzerland in the Year 1994

Table 1 shows the number and categories of commodities that were subject to analysis as well as their origin (Swiss or foreign). The pesticide residues found in these different agricultural products are summarized in Figures 2 and 3.

A total number of 4663 samples were analysed. 5% (232) of these samples contained pesticide residues above the MRL and 34% contained tolerable residues. In the remaining 61% of the samples no pesticides could be detected. 173 of the rejected samples were imported and 59 samples were Swiss products. In Table 2 the samples that violated the MRLs by far are listed separately for domestic and import products.

Table 1
Summary of the agricultural products analysed during 1994

Commodities	Domestic	Import	Total
Cereal & Cereal Products	290	171	461
Fruits	621	1024	1645
Vegetables	1211	1235	2446
Potatos	111	—	111
Total	2233	2430	4663

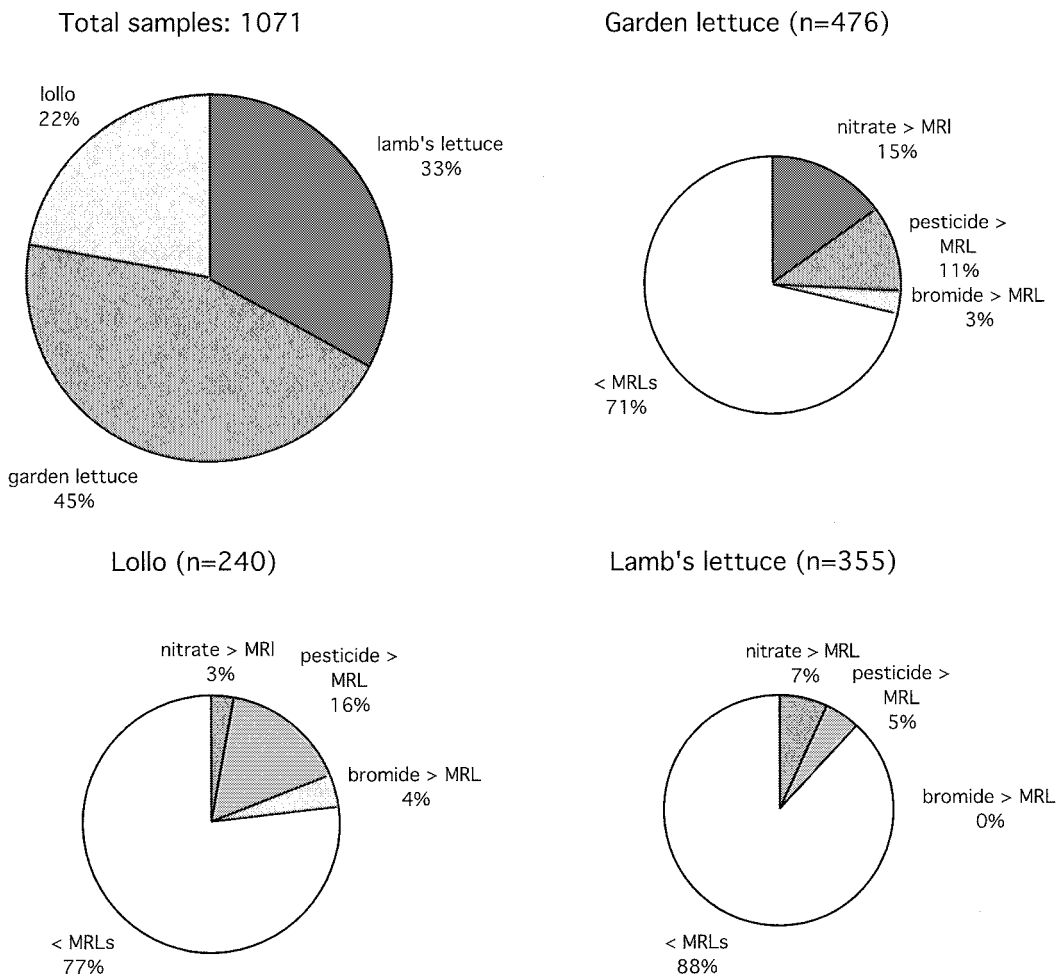


Figure 1
 Summary of the winter vegetable survey, November 1991 to January 1995

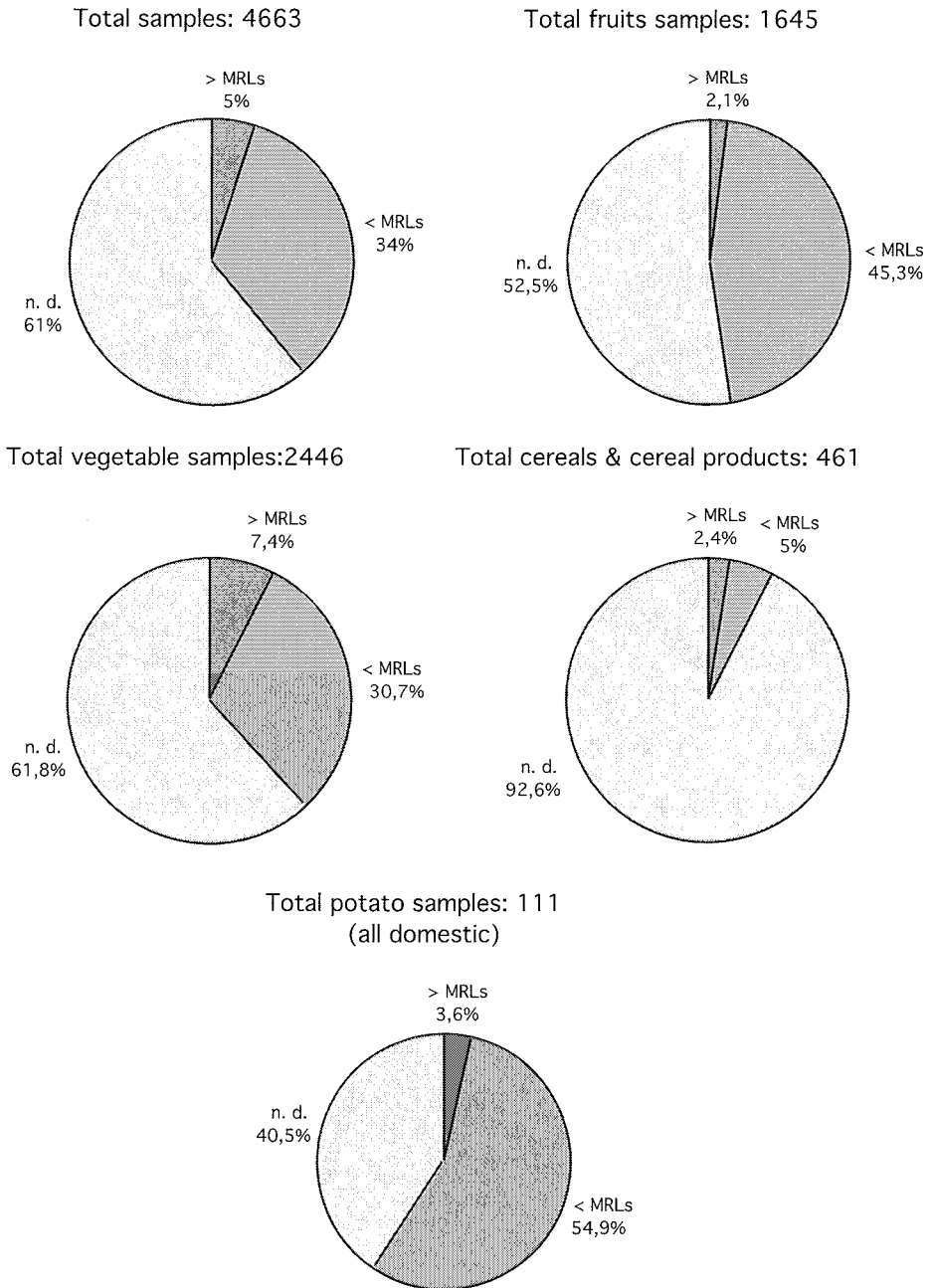
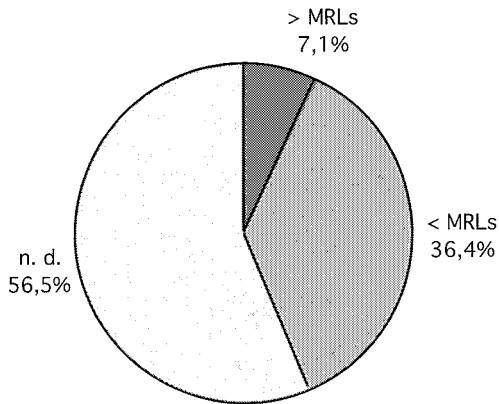


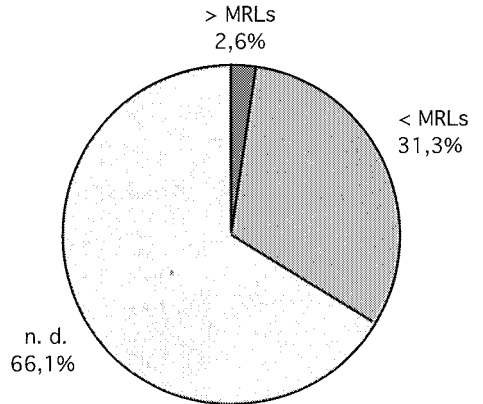
Figure 2

Summary of the pesticide residues according to the MRLs in different crop groups; year 1994; MRL= maximum residue limit, n.d.= not detectable

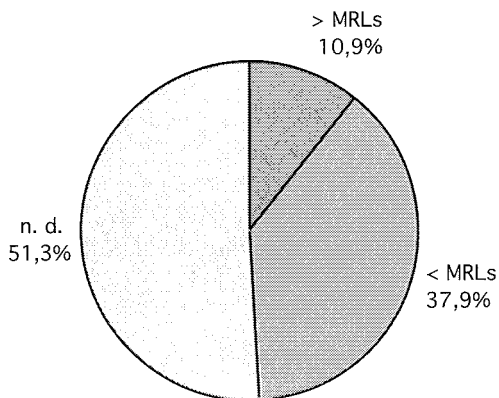
Total imported samples: 2430



Total domestic samples: 2233



Import vegetables: 1235



Domestic vegetables: 1211

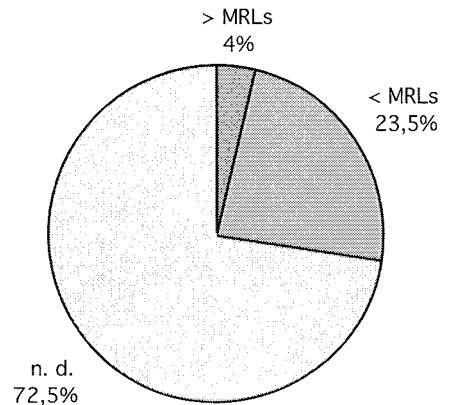
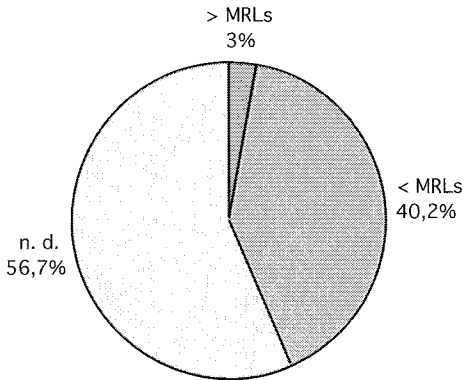
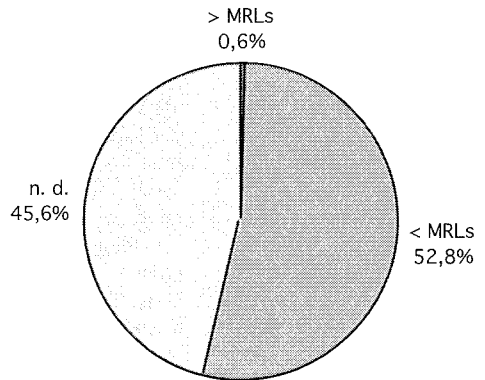


Figure 3
Summary of the agricultural products analysed during 1994.

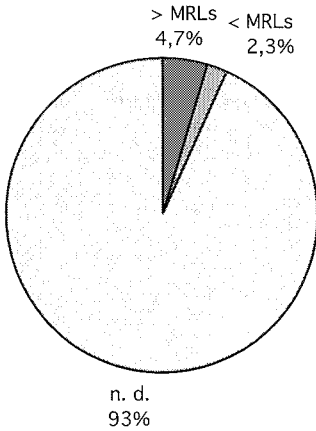
Import fruits: 1024



Domestic fruits: 621



Import cereals & cereal products: 171



Domestic cereals & cereal products: 290

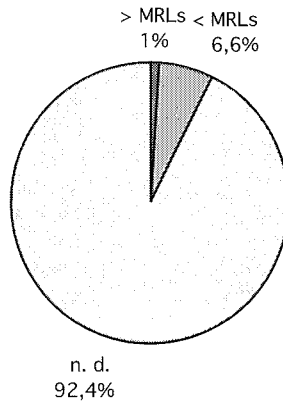


Figure 3 (Cont.)
 Summary of the agricultural products analysed during 1994.

Table 2
Overview of the severe violations: domestic and import products

IMPORTED PRODUCTS

Commodity	Pesticide	Concentration [mg/kg]	Tolerance Value [mg/kg]	Limiting Value [mg/kg]
batavia salad	bromide	220	100	200
batavia salad	dithiocarbamate	6.4	2	6
batavia salad	dithiocarbamate	6.5	2	6
batavia salad	dithiocarbamate	12.0	2	6
cassis	dithiocarbamate	7.5	2	-
cassis	dithiocarbamate	8.0	2	-
cherries	vinclozolin	0.5	0.05	-
garden lettuce	folpet	9.2	2	-
garden lettuce	folpet	11.1	2	-
garden lettuce	iprodion	18.5	6	12
grapes	malathion	1.9	0.5	-
lollo	bromide	200	100	200
lollo	bromide	230	100	200
lollo	bromide	288	100	200
lollo	bromide	323	100	200
lollo	bromide	380	100	200
lollo	bromide	385	100	200
lollo	bromide	550	100	200
lollo	procymidone	10.3	2	-
rucola	bromide	220	100	200
strawberries	chlorpyrifos	0.5	0.1	-
strawberries	dithiocarbamate	6.7	2	-

DOMESTIC PRODUCTS

Commodity	Pesticide	Concentration [mg/kg]	Tolerance Value [mg/kg]	Limiting Value [mg/kg]
celery	fonofos	0.13	0.05	-
celery	heptenophos	1.2	0.05	-
garden lettuce	dithiocarbamate	10.0	2	6
garden lettuce	dithiocarbamate	10.6	2	6
garden lettuce	dithiocarbamate	12.6	2	6
garden lettuce	dithiocarbamate	13.0	2	6
garden lettuce	folpet	12.8	2	-
lamb's lettuce	dithiocarbamate	10.7	2	6
lamb's lettuce	dithiocarbamate	12.8	2	6
lettuce	dithiocarbamate	9	2	6
lettuce	mercaptodimethur	0.67	0.05	-
lollo rosso	dithiocarbamate	7.3	2	6
raspberries	chlozolate	0.3	0.1	-
strawberries	chlozolate	3.2	1	-
wheat semolina	bromide	440	50	-
wheat semolina	bromide	465	50	-
wheat semolina	bromide	479	50	-

LITERATURE

'Law relating to food': Bundesgesetz über Lebensmittel und Gebrauchsgegenstände (Lebensmittelgesetz, LMG) vom 9.10. 1992; SR 817.0*

'Ordinance on food': Lebensmittelverordnung (LMV) vom 1.3.1995; SR 817.02*

'Ordinance on foreign substances and ingredients in food': Verordnung über Fremd- und Inhaltsstoffe in Lebensmitteln (Fremd- und Inhaltsstoffverordnung, FIV) vom 26.6.1995; SR 817.021.23*

'Swiss Food Book': Schweizerisches Lebensmittelbuch (SLMB), Kapitel 46 Pestizidrückstände (Methodensammlung)*

* Can be purchased at: EDMZ

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