Questions / Answers

Jean Harzig, L'Echo
Could this work be used in an ISO 14000 type approach?

Philippe Marie
Of course. This is an overall approach. It is clear that the ISO 14000 procedures are very closely involved with environmental aspects and enable a rational agriculture approach.

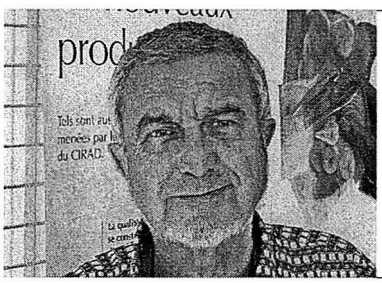
Jean Harzig
You did not mention water aspects and especially the question of nitrogen residues in water. Is work being carried out on this?

Philippe Marie
In the tropics, priority must be awarded to pollution by pesticides, which is much more serious than nitrogen pollution. The tropical environment has specific features in this respect in comparison with the situations in metropolitan France or in Europe. This does not mean to say that one should not approach the problem of the nitrogen and potassium 'greediness' of our banana plantation crop management sequences.

Jean Harzig
Alain Normand mentioned the question of potable water with regard to pesticides but couldn't we also have addressed it with regard to nitrates?

Philippe Marie
Absolutely. But there are also problems of bacteriological quality.

Michel Griffon
To take up the point of nitrogen, an interesting question that does not only concern banana plantations is the fact that a large proportion of nitrogen fertiliser is released in gas form (NO_2), whose radiative effect in terms of the greenhouse effect is between 100 and 104 times that of carbon dioxide, accused as being the leading culprit. When an international market of rights to pollute—or rather complexing certificates—is truly established, it is to be hoped that it does not cover only carbon but all the formulae that reduce NO_2 emissions and enable the rational reduction of fertilisation. This will be extremely useful because this concerns not only banana plantations but also all very intensive cropping ■



Residues in pineapple from West Africa on arrival in Europe

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The question of maximum residue limits (MRLs), and especially that for ethephon, is currently the most acute problem weighing on the pineapple industry. Large-scale actions such as those envisaged by COLEACP at European Union level are therefore a priority, but they should be based on technical data. Some are presented succinctly here.

In export pineapple growing, two types of substance are generally applied to the fruits before or after picking:

- ethephon sprayed on the fruits in the days before the harvest to activate and homogenise peel colour;
- fungicide applied just before the fruits are packed to control rots caused in particular by *Ceratocystis paradoxa*, which penetrates via wounds and the cut stem. The two substances mainly used are triadimefon and imazalil.

This talk mainly concerns ethephon, but data concerning fungicide residues and quality criteria will be covered rapidly.

Ethephon

Ethephon, in the form of the commercial product Ethrel, is applied manually by spraying on the fruits. It is an ethylene generator that causes the break-down of the chlorophyll in the peel and thus the appearance of orange pigment, but without accelerating any other fruit maturation process. Application too early will therefore result in the colouring and harvesting of immature fruits (with a low sugar content and excessive acidity), and taste that is all the more deplorable as pineapple acidity increases during chilled transport. In addition, only very strong doses of ethephon are effective on immature fruits.

Until recently, no European Community regulation set a specific limit for pineapples. The reference was

that of 'all fruits and vegetables' (0.05 mg/kg). Only three countries—France, Germany and Spain—had specified limits, set at different levels (2 mg/kg in the first two countries and 0.1 mg/kg in the third).

Very recently, directive 2000/42, published in the *Official Journal of the European Communities* on 30 June 2000, set the maximum admissible level for all the countries of the European Union at 0.5 mg/kg. This directive will come into force on 1 July 2001.

Aware of the risks, pineapple growers in West Africa, and especially those in Côte d'Ivoire, have already been carrying out work for some time that should make it possible to review the situation and gain a better understanding of the problem.

I therefore summarise here the results of the various observations made, and especially those performed since 1999 within the framework of the project for the re-launching of pineapple in West and Central Africa (Pineapple from West and Central Africa: residual levels on arrival in France of ethephon applied before the harvest and fungicides applied after the harvest — J. Marchal, M.N. Ducamp, M. Lebrun, March 1999). The observations were performed on the fruits after air or sea transport. Ethephon residues were analysed on a blind basis by independent laboratories.

The following residue levels were recorded in a first series of observations of 99 batches:

- 22 batches < 0.5 mg/kg,
- 52 batches > 0.5 and < 2 mg/kg,
- 25 batches > 2 mg/kg.

If the future regulations with a limit of 0.5 mg/kg had been applied, only 22% of the batches would have been able to enter European Union countries. This result is all the more alarming as simultaneous analyses of pineapples from Costa Rica and the Dominican Republic revealed acceptable residue limits of 0.01 and 0.03 mg/kg respectively.

Later observations of 20 batches revealed the following residue levels:

- 11 batches < 0.5 mg/kg,
- 9 batches > 0.5 and < 2 mg/kg.

The situation seems better here, but 45% of the batches would still have been refused.

Such an alarming situation can only be the result of very high doses applied to immature fruits, confirming the analysis of the fruits: only 12% had a sugar content of more than 14%, although this is considered as the minimum for a quality fruit.

More accurate data was gathered by performing analyses after a simple experiment in which the quantity of ethephon, the moment of application and fruit calibre were varied. Ethephon doses corresponding to 3, 6 or 12 l/ha were applied 7, 4 and 2 days before harvesting, taking care to ensure complete wetting of the fruit with approximately 30 cc of solution (i.e. a volume of approximately 1 800 litres per hectare). The results lead to the following conclusions:

- fruit weight has a very marked effect on the residue level. There is therefore a strong phenomenon of dilution of the substance in the fruit mass. As fruit calibre is necessarily heterogeneous in a field, respect of the future standards will require consideration of only the data for small fruits, unless it is decided not to sell these any more.

- The spraying to harvest time also has a very marked effect. A period of 7 days would seem to be essential between spraying and picking. The some ten days that elapsed between fruit picking and analysis—consisting mainly of transport—did not erase the effect; it is therefore possible that the temperature and metabolism of the fruit when it is still on the plant play an important role in the breakdown of the substance.

- Under the conditions of the trial, only the application of 3 l/ha ethephon 7 days before harvesting results in the conformity of all the fruits with the new standards.

These data of course deserve to be refined by investigation of the levels attained with applications at between 7 and 4 days and doses of between 3 and 6 litres, the effect of the climate, the volume of solution applied (preliminary tests seem to show a marked effect). However that may be, it has been proved that respect of the future standards is possible, but with the use of application procedures that are substantially different to present practices.

Fungicide residues

The data are taken from the same observations performed within the framework of the re-launching of pineapple in West and Central Africa. In the light of the forecastable evolution of European legislation, imazalil and triadimefon residues should be lower than the detection threshold, that is to say 0.01 mg/kg for these two substances.

Under these conditions, when imazalil is used, the residue levels are always higher than the maximum authorised. In the other cases, only 33% of the fruits

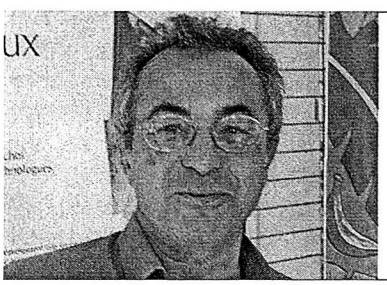
display triadimefon levels lower than the detection threshold. This is the most commonly used fungicide, but it is not impossible that pineapples in conformity with the future standard may not have been treated at all. In such a case, the proportion of fruits that have been treated and in conformity with the standards would be even smaller.

For these substances—unlike the position for ethephon—pineapples from the Dominican Republic and Costa Rica are not in conformity with the standard either.

It should be reminded that it was recommended in the past that these fungicides should only be applied to the cut stem. However, for reasons of economy, treatment has since been by soaking the entire fruit. It is possible that a return to the old practice would be sufficient for respect of the standards.

In conclusion, the application from July 2001 onwards of the new European standard for pesticide residues should lead pineapple producers to pay particular attention to the use of ethephon, with regard to dose, period between application and fruit harvesting, volume of solution and application method. The problems related to the use of this substance should only be considered as extremely urgent insofar as they interfere very strongly with organisation of the sub-sector and have a serious adverse effect on fruit quality. However, the results obtained concerning the two fungicides show that this is not the only problem: if the future constraints are cumulated (ethephon level lower than 0.5 mg/kg, imazalil and triadimefon levels lower than 0.01 mg), only 6% of the batches observed in 1999 and 2000 would have been able to enter the European Union from July 2001 onwards.

The knowledge gained in the past using other crop management sequences, like those shown here, encourage a measure of optimism. However, observations should be broadened, appropriate techniques defined and, above all, their implementation conditions and all their consequences should be specified and applied. Twelve months seems short ■



Research and evolution of the pineapple industry

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The pineapple industry is subjected to two major constraints—maximum residue limits and quality—but it can be seen that the lifting of one will strongly improve the other. Among other things, this involves the extremely interesting Pesticides Initiative programme of COLEACP and Mrs Guichard. In addition, Alain Pinon's talk might be the first technical contribution to this programme.

Ethephon: the reasons for the problem

In order to understand the problems of ethephon residues in pineapple, it is necessary to understand above all what has led growers to exaggerate in the use of the substance. Fields are treated with very large amounts of ethephon when the fruits are totally immature, essentially to respond to problems of harvest organisation and logistics rather than problems of cost or collection. The sight of workers harvesting all the fruits in a pineapple field in one operation is a fairly surprising one. It would not seem possible to imagine that peaches, strawberries or bananas harvested in this way would meet the new quality standards.

These difficulties of organisation are more important for smallholders than for large growers since transport facilities and very early freight reservation are required, with the obligation (with a financial constraint) of respecting these reservations.

Another reason for the phenomenon is the risk of the downgrading of fruits because of black spotting or serious blemishes.

- According to the graph illustrating the percentage of fruits with at least one black spot according to their sugar content, all the fruits with a Brix level of less than 15° were free of black spots during a period of strong occurrence of the anomaly. The problem of black spots is therefore greater when the pineapples are sweet. One can say, without knowing why, that 72% of the fruits are affected or that 38% of the fruits are sound, depending on whether one is pessimistic or optimistic.