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**RE : APPLICATION A443**

**IRRADIATION OF TROPICAL FRUITS - BREADFRUIT, CARAMBOLA, CUSTARD APPLE, LITCHI, LONGAN, MANGO, MANGOSTEEN, PAPAYA, AND RAMBUTAN.**

**INTRODUCTION**

Action for Environment is a voluntary Wellington based group formed in 1972. Our primary aim is to undertake responsible action for the protection of the environment, locally, nationally and internationally.

**SUMMARY**

Action for Environment opposes the introduction of irradiation for the phytosanitary treatment of tropical fruits.

We believe irradiation of these fruits will not be in the interests of New Zealand or New Zealand consumers.

The irradiation process will deleteriously affect the appearance of the fruits and will also result in a serious depletion of the vitamin content of the fruits.

As the irradiation process does not kill fruit flies but rather is designed to sterilise them, it is extremely likely that shipments of fruit would arrive containing live fruit fly larvae or eggs. Studies have shown low levels of residual fertility in at least one species of Fruit Fly after irradiation. We believe that there is a real possibility that some of these surviving larvae may not have been sterilised. Given the potentially disastrous consequences to New Zealand's horticultural industry we do not believe the minor possible benefits to New Zealand consumers justify the risk of allowing the importation of fruits treated by this process.

## **SUBMISSION**

### **EFFECTS ON THE QUALITY AND APPEARANCE OF FRUITS**

#### **Appearance**

The response of tropical fruits to irradiation is quite different to that of non-tropical fruits such as the strawberry. The overwhelming majority of the mangoes produced in Australia (over 80%) are of a single cultivar, Kensington Pride. Studies have found<sup>1</sup> that irradiation can have a number of negative effects on this type of mango. Firstly at overall doses as low as 100 gray the ripening process in the fruit is halted. (The Australian mango is normally picked when it is still firm and green in order to prevent the fruit being over-ripe when it reaches markets). The irradiation process also results in effects on the skin colouration of the fruit. Uneven colour spotting results and pores on the surface of the fruit turn black, in addition the skin is bronzed resulting in a mottled browning effect. The end result is hardly likely to be prime fruit that will appeal to discerning NZ consumers. The South African mangoes for which there have been claims of successful irradiation processing are of a quite different cultivar (Zill & Haden type cultivars) to the Australian variety and have different ripening processes<sup>2</sup>. It is questionable how many fruits are suitable for irradiation. (A study in 1983<sup>3</sup> concluded that only 8 out of 27 common fruits would be suited to irradiation). The markedly different reactions of different cultivars of the same fruit further complicates the matter. We believe that it is quite inappropriate to even consider an application for irradiating a wide range of tropical fruits without detailed studies on each fruit and the particular cultivar which is being considered looking at effects on appearance, flavour and aroma (studies on irradiated Bartlett Pears found significant negative effects on the flavour)<sup>4</sup>.

#### **Quality**

Irradiation causes significant losses in nutrients in food. In particular it causes a serious depletion of a wide range of vitamins including vitamin C. Fruit are a major dietary source of vitamin C and numerous studies<sup>5</sup> have shown that the irradiation of fruits causes substantial or total depletion of the vitamin C content of the fruits. Other vitamins that are depleted by irradiation are vitamins A, D, E, K and B vitamins (particularly B1, B2, B3, B6 and B12). This vitamin depletion continues during storage and can result in virtually complete nutritional erosion. (It should be noted that the vitamin losses from irradiation would be in addition to any normally occurring losses). In short, fruits which have been irradiated are not wholesome or nutritionally adequate and the quality of the fruits is significantly impaired. It is hard to equate these facts of nutritional degradation with the proposed consumer benefits which are discussed in the application.

### **THE DANGER OF THE IMPORTATION OF LIVE FRUIT FLY LARVAE**

As noted in this application irradiation unlike chemical treatments such as Methyl Bromide does not kill the fruit fly, "it targets their reproductive and developmental abilities often without killing

them". It is very likely that shipments of irradiated tropical fruits will contain live Fruit Fly larvae . Given the potentially disastrous consequences for NZ's horticultural industry of the introduction of Fruit Flies to NZ the question of guaranteeing the sterility of these surviving fruit fly larvae is of vital importance. The application specifies a maximum irradiation dose of 1 KGray, yet some experts<sup>6</sup> state that 1 KGray should be a minimum dose for complete insect deinfestation. There is no discussion in the application of required minimum dosage

The key problem is whether it can be ensured that there will be an adequate dose level throughout the whole shipment of fruit - i.e. the problem of ensuring "dose uniformity". A study of the irradiation of spices<sup>7</sup> found that when spices are irradiated in bulk at 30KGray the dose received in the centre of the shipment is unlikely to exceed 10KGray. The question of Dose Uniformity is particularly relevant when dealing with fruits with hard kernels such as mangoes. A study<sup>8</sup> found that for mangoes a dose of 650 Gray was necessary to ensure a minimum dose of 300 gray throughout.

Besides the radiation source (E-Beams, Gamma Rays, X-Rays) there are three important factors which affect the effectiveness of the irradiation process. The distance of the food from the irradiation source, the bulkiness of the food and its heterogeneity. It is of concern that there is no detailed information in this application regarding proposed procedure for irradiating these fruits. Important points on which information is totally lacking are :-

1. The distance of the fruits from the radiation source
2. Whether there will be a single radiation source or multiple
3. Whether there will be a single pass over the radiation source or multiple
4. If there is a single radiation source will the fruit be rotated or turned over to ensure even dosage on all surfaces, including the ends
5. How will the fruit be packed when it is irradiated - is it loose, in trays or in cases?

As mentioned previously it is inevitable that there will be live Fruit Fly Larvae in shipments of irradiated fruit. It was noted by Carpenter and Baker<sup>9</sup> that It would be impossible for Point-of-Entry inspectors to determine if a living Larvae was sterile or not (It should be noted that studies have shown some low levels of residual fertility in at least one species of Fruit Fly)<sup>10</sup>. At best this would result in the need for further treatment of the shipment, at worst a confirmed outbreak of of Fruit Fly could result in massive disruption for NZ's horticultural exports<sup>11</sup>.

New Zealand, as most other countries, uses a security system based on a statistical Probit-9 level of security. (The treatment should kill 99.968% of pests, i.e. less than 32 survivors are found per million tested). In the United States the USDA has discussed the question of the relevance of the US's current efficacy standards for commodity treatment for Fruit Fly<sup>12</sup>. The discussion focuses on whether the current Probit 9 statistical standard should be replaced by a Risk Management approach. While a Risk Management approach to problems such as Fruit Fly may (though we doubt it) be appropriate in the US, we believe that it would be irresponsible and dangerous to adopt such an approach in NZ. The structure of the NZ

economy is quite different to the US and our reliance on primary produce exports is far higher.

## THE ANALYSIS OF ALTERNATIVES TO IRRADIATION

It should be noted that the Applicants analysis of alternatives to irradiation treatment is both cursory and inaccurate. In particular the characterisation of Cold Treatment as “not an economical measure because of product damage and high costs” is debatable as it could be applied during transport to markets in refrigerated containers. It is also curious that other treatment methods such as Controlled Atmospheres and alternative chemicals were not mentioned.

## COSTS AND BENEFITS

The analysis in this application of the likely costs and benefits of the irradiation of tropical fruits is superficial and seriously flawed.

We find it extraordinary that the potentially massive effect on New Zealand horticultural industry is not noted in the Impact Analysis discussion. It is even more curious that there seems to have been no consultation with or even notification of the NZ Horticultural Industry or ENZA.

It should have been noted that there is clear evidence that irradiation of fruits causes serious depletion of their vitamin content and can result in the complete erosion of the nutritional content of the fruits. There seems little basis for the claims of consumer benefits.

In the absence of any evidence of initiatives from the Queensland Fruit and Vegetable Growers regarding the need for irradiation the claim of benefits to producers is simply trivial and specious.

We find it bizarre that a food regulatory authority like ANZFA should view the possible “increased market available for operators of Irradiation facilities” as something they should consider or even discuss.

## CONCLUSION

We believe that this application should be rejected as it is not in interests of the NZ consumer, the NZ horticultural industry, the NZ government or we suspect the Queensland Fruit Growers.

1. The increased availability of tropical fruit is of no real benefit to the NZ consumer if the fruits are totally depleted of any vitamin content and nutritional value even if the taste is not affected (which is by no means certain<sup>13</sup>).

2. As we have detailed the potential costs to the NZ Horticultural Industry and the New Zealand economy (and, it should be added, to the NZ taxpayer who will have to foot the bill for any eradication program) are huge.
3. The question of the benefits to the Queensland Fruitgrowers is problematic at best. indeed there is no evidence that the problems defined in this application are perceived by the Queensland Fruit growers as being of any significance whatsoever. It is interesting that the application was submitted by an Irradiation Processor with no supporting testimony from any Queensland fruitgrower. The benefits to the fruitgrowers seem marginal at best. As we detailed earlier only a small percentage of the Queensland Mango crop is suitable for irradiation. There is no supporting evidence that any of the other fruits for which the application has been made are any more suitable. The irradiation process will be an extra cost to the fruitgrowers and an extra complication in the distribution process. It is hard to see that these costs and problems would be justified by the minimal increase in sales that are likely (particularly given the evidence of NZ consumer resistance to Irradiated foods). It should be noted that the Queensland Fruitgrowers are very sensitive to perceptions of their products. They note on their website<sup>14</sup> that “as responsible custodians of our natural resources, growers are increasingly adopting sustainable farm management practices and earning a strong reputation as safe food producers. Our clean, green approach is recognised around the world”. It is not likely that they would risk the damage that Irradiation of their produce could cause to that reputation for the trivial (and possibly illusory) economic benefits of selling small amounts of fruit to NZ.

In summary, we believe that this application just makes no sense economically, the likely benefits are at best trivial and the the potential negative effects huge. There is no evidence of any indicated need from producers or consumers that could in any way justify taking the risks that would accompany allowing this procedure.

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## FOOTNOTES

1. Boag, T.S. (1987). House of Representatives Standing Committee on Environment Inquiry into Use of Ionising Radiation, Hansard pp.2226-2260. Canberra ACT
2. Boag (1987)
3. Akamine, E.K., and Moy, J.H. (1983). In "Preservation of Food by Ionizing radiation" Vol.3 (E.S. Josephson and M.S. Peterson, Eds), pp. 129-158. CRC Press Florida
4. Maxie, E.C, Sommer, N.F, Muller, C.J. & Rae, H.L. 1966 Plant Physiol. 41 pp 437-442  
The flavour of the irradiated peaches was judged to be "insipid and atypical".
5. a. Rose, R.C. (1987), Ann.N.Y. Acad. Sci. 498, pp506-508  
b. Murray, David.R, "Biology of Food Irradiation" Taunton, Somerset, England. Research Studies Press. 1990  
c. Mathur, P.B., Lewis, N.F. "Storage Behaviour of Gamma Irradiated Mangoes" Int. J. Appl. Radiat. Isot. ; IJARA; (1961); v.11. pp 43-45.
6. Murray (1990)
7. Peters, F.E. (1988). House of Representatives Standing Committee on Environment Inquiry into Use of Ionizing Radiation, Hansard pp3774-3841. Canberra, ACT
8. Boag (1987)
9. Carpenter, A., Baker, R.T. "The Place of Food Irradiation for Insect Control on Fresh Produce Entering and Leaving new Zealand : Prospects and Problems" Proceedings of the food Irradiation Session of the 56th Congress of the Australian and New Zealand Association for the Advancement of Science". Massey University 1987.
10. Williamson, D.L., Mitchell, S. & Seo, S.T. 1985. Annals of Entomological Society of America 78. ppp101-106
11. "An outbreak of Fruit Fly would mean, at the least, that no exporting could be done from within an 80 km radius of the locus..... an outbreak in Auckland would halt all produce movement through Mangare International Airport and the Port of Auckland. No exports would be permissible from the affected area for at least a year after eradication". (Carpenter & Baker. 1987).
12. "Alternatives for Quarantine Security". USDA Discussion Paper.  
<http://www.ars.usda.gov/is/np/mba.jan97/secure.htm>
13. As far as we are aware no detailed testing of consumer perceptions of taste of irradiated fruits such as that done by Maxie et al has been done on any of the fruits listed in this application.
- 14 <http://www.qfvg.org.au/industry/industry.html>