Sulphur dioxide residue levels in irradiated fruit

Sulphur dioxide residue levels and incidence of spoilage in South African 'Mauritius' litchi fruit irradiated according to USA phytosanitory specifications and stored under airfreight export conditions.

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Abstract
A study was performed to establish whether irradiation for phytosanitary purposes will negatively influence the quality of 'Mauritius' litchi fruit stored under air freight simulation conditions. To do this, the fruit were placed into insect proof netting and gamma irradiated at five rates (0, 0.6, 0.8, 1.0 and 1.2 kGy). From the results it may be concluded that phytosanitary irradiation of correctly fumigated 'Mauritius' fruit of appropriate maturity should not to increase the sulphur dioxide residues in the aril of the fruit. Nor should it increase fungal infections on the pericarp. It would further appear that the insect proof netting ought not to influence the quality of the fruit negatively.

Introduction
Phytosanitary regulations in the United States of America require that litchi fruit imported from South Africa be irradiated. The present study was performed to establish whether the irradiation process has a negative influence on the quality and sulphur dioxide residue levels of 'Mauritius' fruit stored under air freight export simulation conditions.

Materials and methods
The trial consisted of the following treatments:
1. No irradiation – fruit packed directly into cartons;
2. no irradiation – fruit packed in insect proof netting in cartons;
3. irradiation at 0.6 kGy in insect proof netting;
4. irradiation at 0.8 kGy in insect proof netting;
5. irradiation at 1.0 kGy in insect proof netting; and
6. irradiation at 1.2 kGy in insect proof netting.

Each treatment consisted of twelve 5 kg carton replicates of commercially fumigated 'Mauritius' fruit packed at the Burpak Packhouse during January 2013. After packing, the cartons were transported at ±12°C to the Hepro facility in Cape Town where they were gamma irradiated on day 4 of the export simulation trial. After irradiation, the fruit was transported under a similar temperature conditions to the Agricultural Research Council's Institute for Tropical and Subtropical Crops in Nelspruit where quality analyses were performed. The following quality related measurements were taken on day 10 of the simulation period:
1. Fungal infections by counting the number of fungal colonies per carton and expressing the incidence as a percentage;
2. Sulphur dioxide residues in parts per million (ppm) of a pooled sample of five fruit per carton using the method of De Vries *et al*. (1986);
3. Total soluble solids (TSS) with five fruit per carton using an electronic refractometer; and
4. Total titratable acids (TA) with five fruit per carton using a 0.1 N NaOH solution.

A second sample of five fruit per carton was taken on day 14 and the sulphur residue analyses repeated.

Results and discussion
The results are summarised in Table 1. The following deductions can be made from the table:
- The fruit were quite mature when packed (the current authors recommend that 'Mauritius' fruit from the area not be exported when the TSS/TA ratio passes the 40 mark).
- The observed variations in fruit maturity were of orchard origin and were not caused by the postharvest procedures.
- The variation in maturity was, however, not such that it influenced the

Table 1. Maturity, aril SO_2 residues and fungal infections of 'Mauritius' litchi fruit irradiated at 5 rates and stored under air freight export simulation conditions.

Treatment no	Irradiation rate (kGy)	Packaging	TSS/TA ratio	Aril SO_2 residues day 10 (ppm)	Aril SO_2 residues day 14 (ppm)	Fungal infections day 10 (%)
1	0	Carton only	41.4 b*	8 bc	5.9 e	53.6 a
2	0	Carton + net	37 b	10.9 a	8.8 b	50.4 a
3	0.6	Carton + net	39.8 b	9 b	6.5 de	18.7 b
4	0.8	Carton + net	46.5 a	8.6 b	10 a	26.8 ab
5	1	Carton + net	41.4 b	8.3 b	8 c	28.6 ab
6	1.2	Carton + net	41.4 b	7 c	7.3 cd	33.2 ab

*LSD ($P<0.05$)

fungal infection rates and aril sulphur dioxide residues of the fruit in a consistent manner.

- The sulphur dioxide residues (5.9 to 10.9 ppm) were within the expected range for mature air freighted 'Mauritius' fruit fumigated for sea freight export purposes.
- The irradiation process did not influence the sulphur dioxide residues in the fruit aril.
- The insect proof netting did not increase the sulphur dioxide residues of the fruit aril.
- The irradiation process did not increase the incidence of fungal infection on the pericarp (interestingly, the fruit irradiated at the lowest dose of 0.6 kGy had statistically less fungal infection than the non-irradiated samples).
- The insect proof netting did not increase the incidence of fungal infections.

From the results it may be concluded that phytosanitary irradiation of correctly fumigated 'Mauritius' fruit of appropriate maturity ought not to increase the sulphur residues in the aril of 'Mauritius' fruit. Nor should it increase fungal infections of the pericarp. The same applies to the insect proof netting used in conjunction with the irradiation process.

Reference

De Vries, J.W., Ge, H., Ebert, J.F., Magnuson, J.M. and Ogawa, M.K. 1986. Analysis for total sulfite in food by using rapid distillation followed by redox titration, *J. Off. Anal. Chem.* 69(5): 827-830.

SALGA research projects for the 2013/14 season

Gerhard Nortjé
SUBTROP

	Institution	Project	Period (years)
1	SALGA	Hepro irradiation	1
2	ITSC	Adaptation of use of Ethapon for flush control and control of leafy flower panicles in various litchi cultivars	3
3	ITSC	Fostering strong bearing harvest flushes after harvest for increased starch reserves and flowering and yield potential	4
4	ITSC	Litchi cultivar evaluation / importation	Long-term
5	ITSC	Entomopathogenic nematodes (EPN's) for the possible control of the false codling moth in litchi	4
6	CRI	Litchi moth 'granulovirus' development project	1
7	ITSC	Monitoring method for stinkbug on litchi	1
8	WTS	Market access	3