Irradiated vegetables

Which ones, what for?

Most irradiation research has centered around tomatoes, potatoes, onions, garlic and mushrooms. In tomatoes the attempt was to suppress the decay mould *Alternaria*. In potatoes, onions and garlic irradiation was meant to inhibit sprouting. And in mushrooms irradiation was supposed to inhibit growth and opening of caps.

Tomatoes

The aim to suppress rotting caused by Alternaria would need more than 3 kGy, while many varieties can only tolerate 1 to 1.5 kGy (1).

Those Australian varieties that could tolerate 2-4 kGy in the green mature stage, underwent pronounced tissue softening. The less mature samples regained practically all of their original firmness within 4 days (2). The problem is that immediately after irradiation the fruits are exposed to mechanical injury because of transport. So, stationary trials only could give a dramatically flattered picture of what the reality would be.

Potatoes

- In German research the varieties Bintje and Saturna were irradiated with 0.085 and 0.15 kGy. (8.5 and 15 krad) to inhibit sprouting. Then chips and dried potatoes from these irradiated varieties were stored for 6 and 8 months. They showed a grey discoloration and the chips made from the same batch were darker than chips from unirradiated potatoes.

After 6 months storage more rotting was found in irradiated potatoes than in chemically treated ones (3). Also, rotting was irradiation dose dependent (4).

- Japanese research found that irradiation induced browning. This varied with where the potatoes came from and the time lapse between harvest and irradiation. It was recommended to irradiate potatoes 1½ to 2 months after harvest, as this gave the least browning. It concerned the Irish cobbler potato (5).
- Polish research found that susceptibility to rotting was increased by irradiation. It concerned the ronda and mila potato var (6).
- Australian research found more rotting in irradiated potatoes after 6 months of storage. It concerned the varieties up-to-date, sebago, sequoia and kennebec. Although the report denied it for the last variety, Table I of the report showed it (7).

The observation was made that irradiation suppressed wound healing in potatoes. This gave microorganisms a longer time to establish themselves resulting in an increased incidence of rotting (7, 8).

After 4 months of storage irradiated sequoias had lost more vitamin C than unirradiated ones (9). Research on different potato varieties established that vitamin C loss after irradiation depended very much on the type of variety (10).

Also, a trend towards breakdown of starch into sugars was noted after irradiation. A sugar content of less than 0.4% (fresh weight) was considered essential for the production of light coloured chips. Only the sebago variety could met this requirement (9).

It was suggested that for domestic consumption a higher sugar content might be acceptable ‘if a total sugar content of 1% were tolerable’(9). Would people accept ‘sweet potatoes’ for every day??

Onions

Onions were irradiated to prevent sprouting. It was found that, depending on the variety, inhibition of sprouting went hand in hand with increased rotting during storage. What seems to happen is that the dying the growing tip where sprouting normally starts, becomes an entry point for microorganisms (11, 12, 13).

Garlic

Garlic tolerates irradiation quite well. There are no problems with rotting as garlic juices kill bacteria and inhibit moulds.

Mushrooms

Mushrooms also tolerate irradiation quite well. Still, irradiation has little to offer over cooling.

- Canadian research found that 1 kGy inhibited the growth of cultivated mushrooms and increased storage life. However, taste panels preferred unirradiated mushrooms (14).
- American research found that 1 kGy was effective and that higher doses tended to discolour the flesh too much (15).
- Other research focused on temperature in combination with irradiation. Mushrooms were irradiated with 0.5 and 1 kGy. Then stored at 4 and 13°C. The shelf life of mushrooms stored at 13°C increased by 2 to 4 days. But the shelf life of mushrooms stored at 4°C increased by more than 14 days. Moreover, they were superior to those stored at 13°C (16). This shows that temperature regulation is much more effective than irradiation.

This conclusion was already made in the 1970s: 'for good quality retention, mushrooms should be stored and shipped at temperatures near 32°F (=0°C) and relative humidity of 90%. This is easily and economically done. Under these conditions irradiation does not contribute a significant effect on stem growth and cap opening (1).

References

1. Maxie, E.C. et al. 1971. Infeasibility of irradiating fresh fruits and vegetables. HortScience 6(3): 202-204
2. Lee, T.H. et al. 1968. Effects of gamma irradiation on tomato etc, Radiation Botany 8: 259-267
3. Penner, H. et al. 1975. Food Science & Technology Abstracts vol.7:10J1439
4. Grunewald, T. 1973. Experience in irradiating potatoes, in : Aspects of the introduction of food irradiation in developing countries. IAEA, Vienna 1973 - PL 518/2, pp. 7-11.
5. Tatsumi, Y. et al. 1975. Food Science & Technol. Abstr. Vol. 7: 2J300
6. Fiszer, W. et al. 1986. Food Science & Techn. Abstr. Vol. 18: 9J43.
7. Wills, P.A. 1965. Some effects of gamma radiation on etc. 1. Storage problems. Austr. J. Exp. Agric. & Animal Husbandry 5: 282-288.
8. Sommer, N.F. et al. 1966. Ionising radiation for control etc. Advances in Food Research 15: 147-193.
9. Wills, P.A. 1965. Some effects of gamma radiation on etc. 2. Biochemical changes. Austr. J. Exp. Agric. & Animal Husbandry 5 : 289-295.
10. Murray, T. K. 1983. Nutritional aspects of food irradiation, in: Recent Advances in Food irradiation (eds. P.S. Elias & A.J. Cohen) Elsevier Biomedical Press, Amsterdam, The Netherlands, p. 205.
11. Nair, P.M. et al. Sprout inhibition etc. Radiation Preservation of Food - Proceedings of a symposium - Bombay Nov. 1972. IAEA Vienna 1973. Sm- 166/11, pp. 347-366.
12. Salem, S.A. 1974. Effect of gamma radiation on storage of onions. J. Sci. of Food & Agricult. 25(3): 257-262.
13. Menniti, A.M. 1980. Bio-pathological effects etc. Food Sci. & Techn. Abstr. Vol.12: 6J879
14. Campbell, J.D. et al. 1968. Gamma irradiation mushrooms. J.Food Sci. 33: 540- 542
15. Skou, J.P. et al. 1975. Effects of ionising radiation on mushrooms etc. Food Sci. & Techn. Abstr.Vol.7: 11J1613
16. Kramer, M.E. et al. 1988. Radiation processing mushrooms. Food Sci. & Techn. Abstr. Vol. 20: 10J135

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