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Research Application Summary

Effects of postharvest handling and 1-MCP treatment on the quality and shelf life of tomato

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Abstract

An experiment was conducted to assess effect of phyticcal impact and storage temperature on ethylene production. There was no significant effect of physical handling on ethylene production, but there was more ethylene production at higher (20^0 C) than lower (12^0 C) temperature. Production of ethylene was lowered by application of 1-methylcyclopropene.

Key words: Ethylene production, *Lycopersicon esculentum*, physical handling, storage temperature

Résumé

Une expérience a été menée pour évaluer l'effet de l'impact physique et de la température de stockage sur la production de l'éthylène. Il n'y avait pas eu d'effet significatif du traitement physique sur la production d'éthylène, mais il y avait plus de production d'éthylène à la plus haute température (20^0C) qu'à la plus basse température (12^0 C). La production d'éthylène a été abaissée par l'application du 1-méthylcyclopropène.

Mots clés: La production de l'éthylène, *Lycopersicon esculentum*, le traitement physique, la température de stockage

Background

Tomato (*Lycopersicon esculentum*, Mill.) is the second most widely grown vegetable crop in the world other than the white potato (Hanson *et al*., 2001). It is a perishable and a climacteric fruit whose shelf life can be reduced by ethylene production which is enhanced by physical impact and high storage temperature. The present study was conducted to assess the effect of postharvest handling and storage temperature on the ethylene production and quality of tomatoes. The study also assessed the effects of 1-methylcyclopropene (1-MCP) application on the production of ethylene and other quality attributes of tomatoes. It was hypothesised that subjecting tomato fruits to mechanical damage causes them to produce ethylene in response to the damage and that this shortens their shelf life. It was also hypothesised that application of 1-MCP to fruits would extend the shelf life of the fruits by inhibiting the production of ethylene.

Literature Summary

Rough handling of fruits such as tomato triggers the production of ethylene which enhances their ripening and early senescence (Kader, 2005). Reid (2000) indicated that ethylene alone can cause postharvest losses of between 10%-20% through undesirable acceleration of ripening, undesirable defence response (russet spotting and bitterness) abscission and senescence. In one study tomato fruits and slices treated with 1-MCP showed reduced ethylene production by 31% in fruits and 24% in slices resulting in firmer fruits and slices in the treated samples (Pangaribuan *et al*.,2003).

Methodology

Two separate experiments were conducted, first to assess the effect of physical impact and storage temperature on ethylene production and then to assess the effect of 1-MCP on ethylene production at two storage temperatures in tomatoes. In the first experiment, 36 of 72 fruits were dropped from a height of 1m and the resulting ethylene produced was measured using Photovac Gas Chromatograph. The remaining 36 were undamaged. Half of each was then kept in one of two temperatures (12^{o}C and 20^{o}C) in a randomised complete block design (RCBD). Colour, respiration, and firmness were measured using colour meter, carbon dioxide meter and durometer, respectively.

In the second experiment, 96 tomato fruits were divided equally into four: (1) 1-MCP treated and damaged, (2) 1-MCP treated but undamaged, (3) damaged without 1-MCP, and (4) undamaged without 1-MCP. They were then kept at 10 ^{o}C and 15^{o}C in a RCBD. Quality attributes were measured in the first and this second experiment.

Research Application

In the first study, there was no significant effect ($P > 0.05$) of handling treatment on ethylene production (Table 1). However, storage temperature had a significant effect on ethylene production with means higher at 20^{o}C than at 12^{o}C. In the second study, 1-MCP treatment had no significant ($P > 0.05$) effect on ethylene production (Table 2). Temperature showed no significant effect on ethylene production.

From the experiments, it can be concluded that rough handling of tomatoes and high storage temperature can increase its metabolic rate leading to the production of ethylene and accelerated ripening. Further, production of ethylene in tomatoes can be lowered by the application of 1-MCP.

Table 1. The effects of damage and storage temperature on ethylene production rates in tomatoes (µl/kg/hr).

Treatment	Day 0	Day 3	Day 6	Mean
Damaged	8.77	4.34	8.80	7.30a
Undamaged	7.75	1.92	2.30	3.99a
LSD(0.05)				NS
Temperature				
12°C	6.69	1.56	2.05	3.42b
20°C	9.84	4.70	9.00	7.85c
LSD(0.05)				3.46

NB: values with similar letters were not significantly different at the 5% significance level. NS= not significant (P> 0.05).

Table 2. The effects of 1-MCP, damage and storage temperature on ethylene production in tomatoes (µl/kg/hr).

Treatment	Day 0	Day 1	Day 3	Day 7	Mean
1-MCP damage	1.74	3.24	0.97	0.80	1.69
1-MCP undamaged	0.58	3.76	1.34	0.63	1.58
Damage	1.29	5.02	3.09	2.32	2.93
Undamaged	1.78	4.74	1.97	1.75	2.6
LSD(0.05)					NS
Temperature					
10°C	1.98	5.70	1.57	1.45	2.60
15°C	0.72	2.68	2.12	1.63	1.78
LSD (0.05)					NS

NS = not significant at P > 0.05.

Recommendation

It is recommended that these experiments be replicated in future to include varietal response to the various treatments or assess the effects of different concentrations and duration of exposure of the 1-MCP treatment on the shelf life of tomatoes.

References

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