氏　名	ANNAH KHATENJE INDECHE
授与した学位	博　士
専攻分野の名称	農　学
学位授与番号	博甲第６０６９号
学位授与の日付	２０１９年　９月２５日
学位授与の要件	環境生命科学研究科　農生命科学専攻 （学位規則第４条第１項該当）
学位論文の題目	Studies on effect of defoliation on blossom-end rot development and calcium transport into tomato fruit （摘葉処理がトマト果実への Ca の転流と尻腐れ果発生に及ぼす影響）
論文審査委員	教授　加藤鎌司　　教授　吉田裕一　　教授　後藤丹十郎　准教授　安場健一郎

学位論文内容の概要

The main objective of the research was to determine the effect of defoliation on blossom-end rot incidence and Ca transport into fruit of tomato cultivars with different fruit size as influenced by environmental factors under moderate water stress, provided by root zone restriction. Two studies were conducted in 2017-2018. The objective of the 1st study was to determine the effect of defoliation on blossom-end rot incidence and Ca transport into tomato fruit cultivars of different size. Four experiments were conducted between January 2017 and June 2018. The start and end dates for each experiment were; 14 March–2 May, 22 July–23 August, 30 August–7 October 2017 and 20 May–25 June 2018, for experiment 1, 2, 3 and 4, respectively. Five tomato cultivars including a large (‘Momotaro fight’), 3 medium (‘Lui 60’, ‘Tio cook’, and ‘Cindy sweet’), and a small (‘Pepe’), size fruit cultivars, respectively, were grown under moderate water stress controlled by a combination of root zone restriction and solar mediated fertigation. Leaf area of plants was reduced by 20-30% by removing alternate leaflets on all leaves. Defoliation significantly reduced blossom-end rot in all experiments. Defoliation increased both fruit growth rate and Ca transport rate into fruit, and there were significant linear relationships between them in all the cultivars. However, degree of increase was apparently larger in Ca transport rate than that in fruit growth rate in the blossom-end rot sensitive large fruit cultivar ‘Momotaro fight’.

In the 2nd study, the objective was to determine the optimum number of whole leaves to retain on a tomato plant for effective blossom-end rot management in ‘Momotaro fight’ and ‘Cindy sweet’ and explore the relationship between shoot Ca and fruit Ca in non-defoliated plants. The experiment was conducted in spring of 2018. Treatments involved maintaining 18, 15 and 12-leaves on the plant. All lateral shoots were removed regularly throughout the growing period except the shoot closest to the flowering truss in the 18 leaves treatment. At the length of 10cm, this shoot was removed for real time Ca determination using a hand held Ca^{2+} meter. In the 18-leaves, blossom-end rot was higher in ‘Momotaro fight’ at 10% compared to 2% ‘Cindy sweet’. Fruit growth rate was significantly different in ‘Momotaro fight’, however, no significant difference was observed among treatments in ‘Cindy sweet’. Defoliating to 12-leaves increased Ca transport rate by 59% and 37% in ‘Momotaro fight’ and ‘Cindy sweet’, respectively. Defoliating to 12-leaves and 15-leaves increased the water soluble Ca concentration in the distal part of fruit. In the plants defoliated to 18-leaves, a significant steady decrease was observed in the concentration of water soluble Ca in the distal part of the fruits with increase in truss order. There was a significant linear relationship between water soluble Ca concentration in the distal part of fruit and shoot Ca concentration in the plant defoliated to 18-leaves. We conclude that under moderate water stress and also certain other blossom-end rot inductive conditions, defoliation to 12-15 leaves on a tomato plant should be a promising approach for managing blossom-end rot in susceptible large fruit cultivars.

論文審査結果の要旨

本研究では，トマト果実のカルシウム(Ca)転流不足に起因する尻腐れ果の発生を制御するため，実際の栽培に適用可能な手法として摘葉処理の効果について検討した。その内容は以下のとおりである。

第 1 章では，果実の大きさと尻腐れ果発生頻度が異なる 5 品種のイチゴを用いて，小葉を交互に摘除して葉面積を制限する摘葉処理が，尻腐れ果が多発する果実発育初期の成長速度，Ca 濃度と果実への Ca 転流速度に及ぼす影響を 4 作型にわたって調査し，尻腐れ果発生との関係について解析した。根域制限栽培により継続的に軽度の水ストレス条件下にあるトマトでは，摘葉処理によって果実成長と果実への Ca の転流がともに促進された。その影響は Ca 転流速度により大きく現れ，果実先端部の水溶性 Ca 濃度が上昇した結果，尻腐れ果の発生は著しく軽減された。その効果は高温・強日射条件下ほど，また果実が大きい品種ほど大きかった。これらの結果を解析し，大玉品種は小玉品種より果実への Ca 転流速度が大きいものの，小玉品種と比較して果実成長速度が著しく大きく，局部的な Ca の転流不足が生じやすいことがトマトの栽培品種で尻腐れ果が多発する根本的な原因であることを明らかにした。

第 2 章では，フィールド科学センターのガラス温室栽培において摘葉処理の効果を検証し，大玉品種では開花中の花房下の展開葉数を 12 枚，中玉品種では 15 枚に調整することよって，果実先端部の水溶性 Ca 濃度が上昇し，尻腐れ果の発生を防止できることを示した。また，開花中の花房直下から発生する腋芽の茎汁液中の Ca イオン濃度と果実先端部の水溶性 Ca 濃度との間に高い相関が認められ，通常の栽培管理の際に摘除される腋芽の Ca イオン濃度を測定することによって，トマト果実の Ca 栄養状態と尻腐れ果発生リスクを診断し，発生防止策適用の要否が判定できる可能性を示した。

以上のことから，トマトの摘葉処理は，実際栽培において尻腐れ果が多発する高温・強日射期に大玉品種の尻腐れ果発生を抑制するためのきわめて実用性の高い技術であると結論付けた。

以上のとおり，本論文は博士（農学）の学位を授与するに相応しいと判断した。