（学位第３号様式）

学 位 論 文 要 旨

氏　名	DOAN CHI CUONG
題　目	ESTABLISHMENT OF THE MATHEMATICAL MODELS FOR TOMATO GROWTH INDICES USING ENVIRONMENTAL FACTORS （環境要因に基づくトマト生育指標の数理モデル構築）

Tomatoes is an important fruit of high economic value in all over the world due to its special character as a high-yield crop among other commonly consumed fruit-vegetables. In horticulture, tomatoes have considered as model plant for studies on the growth of vegetative and fruit development, including fruit maturing mechanism and postharvest ripening. To identify tomato growth periods, confirmation of flower clusters occurrence is important because the date of first cluster coming will be valid as the base date for counting duration of each growth periods. Furthermore, tomato clusters are continuously and regularly produced on the stems; thus, the growth stages between every cluster overlap, and these growth conditions are gradually dissimilar. Therefore, to presently comprehend tomato growth conditions, precise estimation for every tomato cluster is critically required. Thus this study investigated the effects of environmental factors such as temperature, solar radiation, humidity, and their cumulative indices as the cumulative heat unit (CHU), the cumulative solar radiation (CSR) and vapor pressure deficit (VPD) related to duration of flower-clusters occurrence (DFO), the opening of flower-buds (OB), the maturation (FM), and the ripening of fruits (FR), the number of flowers (NFl), number of fruits (NFr), fruit perimeter (PFr), and the fruit-cluster weight (CWt) by mathematical models using multiple linear regression (MLR).

Temperature, humidity, and solar radiation are environmental indices that easy to record and monitor. However, they vary and fluctuate substantially with season and time under the undeniable impacts of climate change. Accordingly, simply and directly applying these indices for evaluating, describing, and predicting the plants' physiological reaction is unreliable and inaccurate. However, this study proves that if these variations are equalized using CHU, CSR, and VPD, they are potential indices to describe and predict the growth characteristics of tomato clusters through mathematical models. CHU and CSR had a significant impact on the occurrence of flower-clusters (r^2 = 0.94, RMSE = 0.71), especially CSR indicated stronger effect on NFl rather than CHU and VPD. There was a

strong significant relationship between CHU and DFO (r^2 = 0.93, RMSE = 0.73). Meanwhile, NFr relied much on VPD than CHU and CSR. Also, pollination condition was sensitive to VPD, NFr and FR were important factors in fruit-cluster weight (CWt). MLR models could explain growth indices of tomato cluster with the coefficient of determination (R^2) from 0.742 to 0.953. These mathematical models via MLR indicated that CHU was the most important factor in DFO and PFr, CSR was the significant variable for NFr in each cluster, and VPD was the crucial factor for NFr on each cluster and CWt. These models can be applied to well-controlled environmental conditions during greenhouse cultivation to attain the desired fruit yield at a specific time and fulfill market demand.