A virtual growth model of the whole structure and dynamics of *Lespedeza dahurica*

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Introduction The environmental and ecological functions and breeding values of forage rely mainly on their development and growth . The functional-structural plant models (FSPMs) are promising way to quantify the development and growth of plants (Yan et al . , 2004) . This paper presents our new result of building FSPM for forage , mainly describing its whole structure , including shoot and root systems .

Principles of structural model description The whole structural model of forage was described by using of dual-scale automaton (Zao et al . , 2001 ; Zhang & Li , 2006) . According to characteristics of the external morphology and growth processes of *Lespedeza dahurica* , as a special case , the physiological ages (PA) were set 10 , to describe the basic growth unit of *Lespedeza dahurica* , PA 0 represented seed ; PAs ranging from 1 to 6 represented basic growth units of shoot system , and PA ranging from-1 to-3 represented basic growth unit of root system . The relationships between different basic growth units were illustrated in Figure 1 .The whole structural model of *Lespedeza dahurica* was developed by combing basic growth units of different PA with the microstates , macrostates and inter-relationships (Figure 1) .

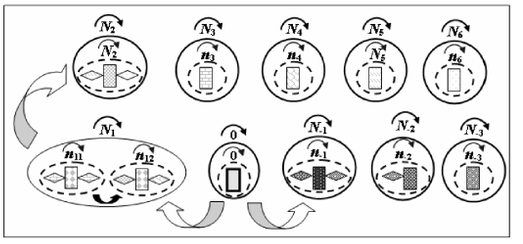

Figure 1 *Illustration of dual-scale automaton model of* Lespedeza dahurica . *The lowercase and capital letters with subscribing number stand for the iterating cycles of microstate and macrostate , respectively . The arrows between macrostates stand for the transfered direction with finishing its iterating cycles of macrostates .*

Parameterisization of model and simulating results Using the greenhouse potted-experiments , the parameters of structural model of *Lespedeza dahurica* were obtained . These parameters include iterating numbers of microstate and macrostates , growth probabilities of different buds and branch probabilities . Structure *model of Lespedeza dahurica* was used to simulate the dynamic structure of Huzhizi under different growth cycles (Figure 2) . The structures of Huzhizi included the numbers , growth ages of different basic growth units and relationships among them .

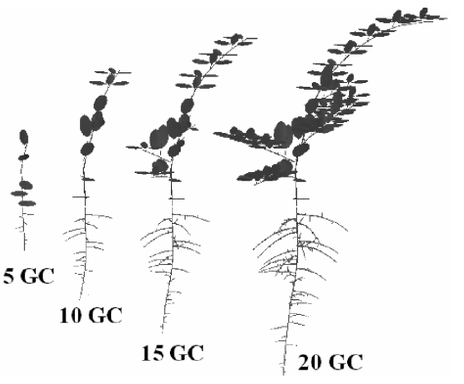

Figure 2 *Virtual 3D structure of* Lespedeza dahurica *under different growth cycles .*

Conclusions A virtual growth model of the whole structure and dynamics of *Lespedeza dahurica* was developed , including shoot and root part at the same detailed scale . By changing the model parameters , the determined and stochastic structure of *Lespedeza dahurica* can be obtained . This is the underlying to complement the function and feedback between structure and function of forage , and to develop the mechanical plant modes which are more faithful to plant growth process .

References

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