Physiological Integration of Photosynthates and Changes of Endogenous ABA and IAA in the Connected Ramets of *Buchloe dactyloides* (Nutt.) Texoka after Supply of Water Heterogeneity

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The XXI International Grassland Congress / VIII International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

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Key words: *Buchloe dactyloides*, physiological integration, photosynthates, water-heterogeneity, ABA, IAA

Introduction Physiological integration in clonal plants can improve their ability to cope with habitat heterogeneity. Whereas the patterns of resource sharing in a great many species of clonal plants are well documented, the mechanism for physiological integration has been explored little (e.g. K. HELLSTRÖM, 2006). As abscisic acid (ABA) regulates plant responses to drought and other abiotic stresses (Davies, 2005), and indole-3-acetic acid (IAA) plays an important role in the regulation of photosynthates sharing in non-clonal plant (De Boer, 1999). We hypothesized that ABA and IAA are the actors for the regulation of photosynthates translocation between connected ramets. To test this, we investigated the patterns of physiological integration of photosynthates and the concentration of ABA and IAA among inter-ramets of buffalograss after the supply of water heterogeneity

Materials and methods A single clone of Buffalograss texoka was propagated through at least ten vegetative generations in a greenhouse at the Chinese Academy of Forestry. For the experiment, newly produced ramets were individually rooted while still connected to their parental stolon in pots containing fine, acid-washed sand. The stolon was then cut at the fourth internode near to the apex as a clonal fragment which includes the oldest ramet (R_1), the younger ramet (R_2), the youngest ramet (R_3) and an apex. The treatment (WS) was that the roots of R_1 and R_3 were cultured in Hoagland solution ($\psi_w \approx -0.05$ MPa), and the roots of R_2 were cultured in Hoagland solution with 30% PEG-6000 ($\psi_w \approx -1.2$ MPa) instead of cultured in Hoagland solution as the control (CK). The clonal fragments were randomly assigned to the treatment and the control with 3 replicates. Labeled $^{14}CO_2$ were fed to R_1, R_2 and R_3, respectively and the amount of ^{14}C-labeling in R_1, R_2 and R_3 were measured 4 hours later. At the same time, the concentrations of ABA and IAA in the R_1, R_2 and R_3 were also measured with ELISA. Data was analyzed using an independent-samples student's *T-test* by SPSS 13.0.

Results ^{14}C-labeling translocation is predominantly acropetal in the clonal fragments of buffalograss (Table 1). However, the amount of ^{14}C-labeling that R_1 ($p<0.05$) and R_3 transported to R_2 increased in varying degrees with 98.89% of ^{14}C-labeling from R_2 reserved within R_2 itself. ABA content in the leaves and the roots of the ramets in all treatments increased although there were no significant differences at 5% between the treatments and the controls, while the IAA content significantly decreased ($p<0.01$) when the R_2 suffered water stress (Table 2).

Table 1 *Percentage of ^{14}C-labeling in R_1, R_2 and R_3 after one of them labeled by $^{14}CO_2$, respectively.*

	R_1	R_2	R_3	Apex
$^{14}CO_2$ fed to leaves of R_1				
CK	91.28ns	8.43	0.24	0.04**
WS	90.23	9.25*	0.52**	0.01
$^{14}CO_2$ fed to leaves of R_2				
CK	0.50ns	91.88	7.53**	0.10**
WS	0.33	98.89*	0.75	0.01
$^{14}CO_2$ fed to leaves of R^3				
CK	0.07	1.45	87.48	11.01**
WS	0.44**	1.79ns	94.50**	3.28

ns = no significant, * $p<0.05$; ** $P<0.01$

Table 2 *Concentration of ABA and IAA in leaves and roots of R_1, R_2 and R_3, respectively.*

	ABA		IAA	
	CK	WS	CK	WS
Leaves of R_1	76.66	84.44ns	86.76**	43.34
Leaves of R_2	73.33	75.08ns	79.93**	42.71
Leaves of R_3	69.07	71.93ns	76.64 **	31.82
Roots of R_1	50.37	65.10ns	63.86**	14.10
Roots of R_2	57.85	65.45ns	52.87**	15.70
Roots of R_3	44.66	55.08ns	44.97**	19.37

ns = no significant, * $p<0.05$; ** $P<0.01$

Conclusions Photosynthates may move both proximally and distally along the stolon in order to support the newly produced ramets or the ramets suffering environment stress, such as water stress. ABA and IAA play important roles in the response to supply of water heterogeneity and the regulation of physiological integration.

Reference

K. HELLSTRÖM, M.-M. KYTÖVIITA, J. TUOMI and P. RAUTIO (2006) Plasticity of clonal integration in the perennial herb *Linaria vulgaris* after damage. *Functional Ecology* 20, 413-420.