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BRIEF COMMUNICATION

Root Water Potential in Polycormon Plants

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Abstract. Water potential of roots was measured by thermocouple psychometers in a series of two or more plants of *Cynodon dactylon* (L.) PERS. interconnected by overground stolons and thus forming one s.c. polycormon. Root water potential was lowest (most negative) in the oldest "mother" plant and increased in younger individua to highest walues in the youngest "doughter" plants. This gradient of root water potential was found although the "mother" plants continued to be watered while watering all daughter plants had been stopped one week before the water potential was measured. Thus the whole polycormon consisting of a series of interconnected individua behaves as one hydrodynamic system where all individual root systems act as if being parts of one sole root system.

It is well known that plant individua forming s.c. polycormons (*i.e.* populations of plants interconnected with overground stolons or underground rhizomes) have a higher competitive ability when penetrating stable plant communities and/or are able to establish themselves on unfavourable habitats more easily than monocormonous individua. The question arose whether this different competitivity in both life forms is not dependent on the different autonomy of the individual plants.

The aim of the paper is to determine the relationship between root water potential of individual members of a polycormon as far as their water supply is concerned in order to ascertain the degree of their autonomy or mutual dependence.

Water potential of primary roots cut off from each root system was measured with droplet thermocouple psychrometer with reference dry thermojunction (RICHARDS and OGATA 1958, modified by KRAMER 1967). Water content of the substrate surrounding the roots was measured gravimetrically (as percent of dry matter). Complex polycormons consisting of several rooted individua of *Cynodon dactylon* (L.) PERS. were grown each in a prismatic container ($12 \times 12 \times 25$ cm) with a 1 : 1 mixture of sand and vermiculite, watered twice a day: once with full nutrient solution once with deionised water in a growth chamber at 28/20 °C day and night temperature

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and 40 ± 5 percent relative air humidity at a 12 h photoperiod. The average lenght of the stolons was 15 cm. Two types of polycormons ware chosen: 1) linear arrangement with unilateral row of individua (30 polycormons of this type were measured) and 2) star-shape arrangement with the "mother" plant in the center of the polycormon (3 polycormons were measured), see Fig. 1. The plants were planted 60 days before the measurement, the "mother" plants were watered until the day of the measurement (which took place at 1 to 2 p.m.). The "daughter" plants were not watered a week before the measurement.

In almost all cases (see Table 1) the root water potential increased from the lowest (most negative) value in "mother" plants gradually to higher (less negative) values in roots of the "daughter" plants. The same sequence

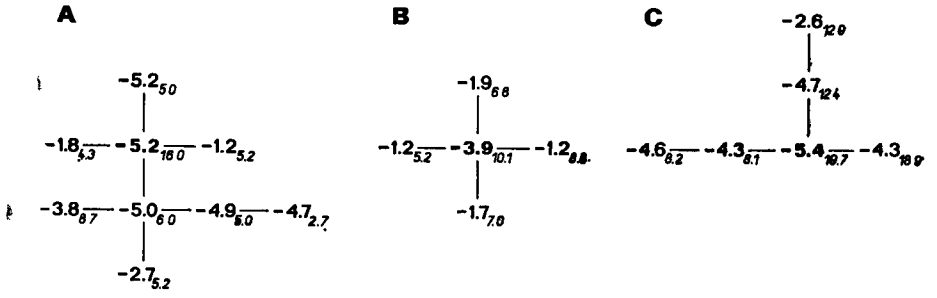

Fig. 1. Examples of the distribution of root water potential in individual plants of star-shape arranged polycormons of *Cynodon dactylon*. Heavy figures denote the water potential of "mother" plants. Water content of the substrate (in percent of dry weight) are in italics.

was also found in star-shaped polycormons (Fig. 1), where the values of the root water potential were arranged almost symetrically around those of the central "mother" plant (with lowest water potential). Surprisingly the root water potential was found to be lowest in well watered "mother" plants with high substrate humidity, while in not watered "daughter" plants (with relatively dry substrate) higher (less negative) values of water potential were found with relatively low humidity of the substrate.

The lowest water potential was always found in the oldest individuum of each polycormon ("mother" plant) *i.e.* in the individuum with the largest root system and the largest leaf area, while it increased (became less negative) gradually in younger (and smaller) individua. Therefore it may be assumed that water was transported along the water gradients through the stolons to the oldest plant during normal daylight transpiration. The whole polycormon behaves like a hydrodynamic complex of plants with interconnected root systems acting as a hydrodynamic unity. Thus a striking resemblance exists with the transport of water and nutrients in tree groups with root grafts which may be considered to be a polycormon in this sense. Results of many papers confirm the translocation of different compounds from one to the other living trees connected through root crafts (*cf. e.g.* BORMANN and GRAHAM 1959, 1960, GRAHAM 1960, WOODS and BROCK 1964, FENTON 1965, GRAHAM and BORMANN 1966). Individual trees did not react as separated units but behaved as members of the whole tree complex in the same way as do the plants of a polycormon studied as above.

The values of the water content of the substrate had no positive correlation with the values of root water potential which decreased in the direction to the oldest ("mother") plant. Just the opposite was found: "Mother" plants had the lowest (most negative) root water potential with the highest water content of the substrate. Hence it may be concluded that the root water potential was not determined by the water content of the substrate around these roots.

As far as water transport is concerned the individual root systems of the plants in a polycormon behave like individual root branches of the root system of a single plant (SLAVÍKOVÁ 1967): their water potential is not determined immediately by the surrounding soil moisture but by the distribution of water potential values in the whole hydrodynamic system of the polycormon.

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TABLE 1

WATER POTENTIAL (ψ_w in bar) of the roots of "mother" plants and linearly arranged "daughter" plants with the water content of the substrate (%, in per cent of dry weight). The arrows denote the direction of possible water transport. $\Delta\psi_w$ is the difference in water potential (bar)

	1		2		3		4	
	ψ_w	%	ψ_w	%	ψ_w	%	ψ_w	%
"Mother" plant	—5.0	16.1	—5.4	19.7	—5.2	16.0	—5.1	19.7
1st "daughter" plant	—1.2	5.2	—4.3	10.9	—1.8	4.3	—5.0	4.3
$\Delta\psi\omega$	—3.8		—1.1		—3.4		—0.1	

	10		11		12		13	
	ψ_w	%	ψ_w	%	ψ_w	%	ψ_w	%
"Mother" plant	—4.7	20.1	—4.8	16.8	—5.1	15.2	—5.2	16.0
1st "daughter" plant	—1.4	16.0	—4.3	12.3	—3.8	10.1	—4.8	12.6
$\Delta\psi_w$	—3.3		—0.5		—1.3		—0.4	

	1		2		3		4	
	ψ_w	%	ψ_w	%	ψ_w	%	ψ_w	%
"Mother" plant	—5.5	19.7	—5.3	20.0	—5.4	19.0	—5.2	17.1
1st "daughter" plant	—4.7	16.4	—4.6	18.1	—4.3	16.9	—5.0	15.3
2nd "daughter" plant	—2.6	14.7	—4.3	8.8	—1.4	5.1	—3.1	9.8

	1		2	
	ψ_w	%	ψ_w	%
"Mother" plant	—5.2	16.0	—4.2	12.4
1st "daughter" plant	—5.0	7.5	—4.4	2.4
2nd "daughter" plant	—5.0	5.2	—3.0	4.5
3th "daughter" plant	—4.7	4.8	—2.0	6.1

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TABLE 1 continued

5			6			7			8			9		
ψ_w		%	ψ_w		%	ψ_w		%	ψ_w		%	ψ_w		%
—4.2	↑	16.9	—4.0	↑	16.1	—2.2	↑	18.7	—1.4	↑	22.7	—2.7	↑	8.9
—2.1	|	7.1	—1.5	|	11.6	—0.5	|	7.8	—0.2	|	16.4	—1.8	|	5.4
—2.1			—2.5			—1.7			—1.2			—0.9		

14			15			16			17			18		
ψ_w		%	ψ_w		%	ψ_w		%	ψ_w		%	ψ_w		%
—5.4	↑	14.7	—4.1	↑	17.8	—5.2		16.0	—4.0		16.8	—4.0	|	17.2
—4.3	|	6.8	—2.1	|	8.1	—5.2		5.0	—4.0		10.0	—7.0	↓	9.2
—1.1			—2.0			±0			±0			+3.0		

5			6			7			8			9		
ψ_w		%	ψ_w		%	ψ_w		%	ψ_w		%	ψ_w		%
—5.2	↑	16.0	—4.0	↑	13.1	—1.0	↓	19.2	—4.1	↑	17.6	—2.1	↓	16.2
—5.1	|	6.0	—4.0	|	14.1	—2.1	↓	18.5	—4.0	|	15.0	—4.1	↓	15.8
—3.6	|	5.2	—1.5	|	13.2	—1.6	↑	18.0	—3.2	|	10.4	—1.6	↑	10.0