Effects of Capillary Rise Interruption Layer on Salt Accumulation and Kentucky Bluegrass (*Poapratensis L.*) Growth in Sand Growing Media Established Over the Reclaimed Saline Soil

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ABSTRACT

This research was conducted to determine the effect of capillary rise interruption layer on the sand based growing media when growing Kentucky bluegrass under soil reclamation and saline water irrigation. Rootzone profile consists of three layers as top soil of 30 cm, 20 cm of capillary interruption layer and 10 cm of reclaimed paddy soil. Rootzone profile was packed in column pots. The top soil was a mixture of sand dredged up from Lake Bhunam Tae Ahn, Korea and peat at the ratio of 95:5 by volume. Bottom part of column was covered with plastic net and the pots were soaked into 5 cm depth saline water reservoir with salinity 3-5 dSm^{-1}.Kentucky bluegrass was installed by sod and irrigated using 2dSm^{-1}saline water(5.7mm day^{-1})in 3days interval.

The results showed that the largest accumulation of salt in the spring with ECe of 5.4 $dSm^{-1}$and SAR34.0 in rootzone with out capillary rise interruption layer and ECe of 4.6dSm^{-1} and SAR8.24 at rootzone using gravel as capillary rise interruption layer material. Kentucky bluegrass grown in growing media with gravel as capillary rise interruption layer resulted in the average visual quality rate of 8.1and clipping dry weight of 24.8gm^{-2}, while Kentucky bluegrass grown in the growing media with out capillary rise interruption layer showed the visual quality rate of 7.9 and clipping dry weight of 34$g.m^{-2}$.Capillary rise interruption layer of gravel and coarses and enhanced the visual quality by 4.1and 4.0%, root length by 50 and 38%, and root dryweight by 35and 17% of Kentucky bluegrass, and reduced the accumulation of Na by 16% and 25%, ECe by 7% and 13% in the rootzone.

Key words: interruption layer, Kentucky bluegrass, reclaimed soil, saline irrigation,

< 국문요약 >

임해 간척지에서 모래상토 층에 모세관수 차단 층의 도입이 염류 집적과 켄터키블루그래스 생육에 미치는 영향

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본 연구는 임해 간척지와 염분의 농도가 높은 관수조건에서 모세관수의 차단층이 염류집적과 켄터키블루

그래스의 생육에 미치는 영향을 알아보고자 수행되었다. 생육지반으로는 표토 30㎝, 차단층 20㎝가 10㎝ 두께의 간척지 토양위에 조성되었다.

표토로는 태안군 부남 호에서 준설된 모래가 사용되었으며 유기물은 부피비 5%로 혼합되었다. 30㎝직경의 PVC 주름관을 절단하여 지반구조 용기가 제작되었고 바닥은 PVC망사를 이용하여 토양의 이동을 차단하였다. 용기는 5㎝깊이의 저수조에 설치되었으며 저수조에는 3-5dsm^{-1}염도의 희석 바닷물이 채워졌다. 켄터키블루그래스는 뗏장을 사용하여 조성되었으며 2Sm^{-1}로 희석된 바닷물이 관수원으로 사용 되었고 일평균 5.7㎜의 관수가 3일 간격으로 수행되었다. 차단층을 생략한 지반은 봄철에 염분의 집적이 최대를 보여 토양전기전도도가 5.4dSm^{-1}에 달하였으며 SAR은 34.0을 보였고 차단층설치구의 토양전기전도도 인 4.6dSm^{-1}과 SAR 8.24 에 비해 현저하게 높은 염의 집적을 보였다. 차단층의 소재별 차이를 볼 때 콩자갈과 조사의 사용시 토양중 Na농도가 가각 16%와 25% 감소하였고 토양전도도는 7%와 13%감소하였다. 차단층 처리구의 켄터키부루그래스 품질은 평균 가시적 평가 8.3을 보여 차단층을 생략한 처리구의 평균 가시적 평가 7.9 보다 높았다. 콩자갈과 조사 차단층 소재는 차단층을 생략한 경우에 비해 켄터키부루그래스의 가시적 품질을 각각 4.1%, 4.0% 증가 시켰으며, 뿌리의 길이를 50%와 38%, 뿌리의 건중을 35%와 17% 증가 시켰다. 상토층의 Na 함량도 콩자갈과 조사 차단층에 의해 각각 16%와 25% 감소하였으며 토양 전기전도도도 7%와 13% 감소하였다.

Key Words : 간척지, 염수관수, 차단층 켄터키블루그래스

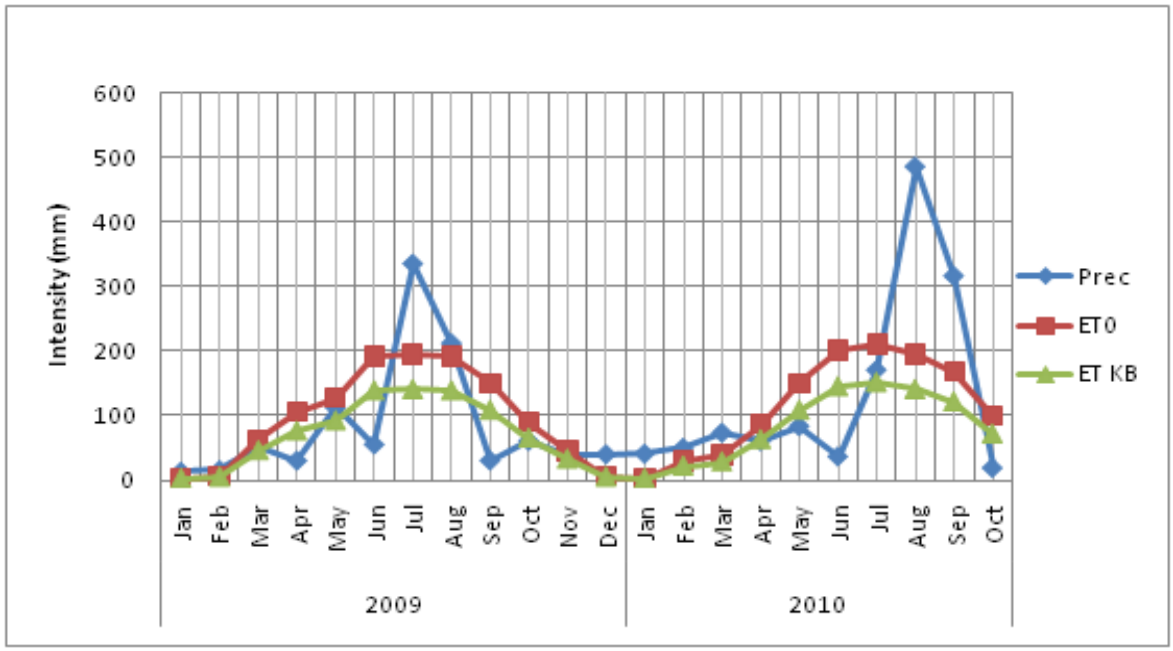

Fig. 1. Monthly precipitation, potential evapotranspiration (ETo) and evapotranspiration of Kentucky bluegrass (ET KB) in Cheonan. Source of data: www. kma.go.kr ETo obtained use Blaney and Criddle Method (1950) (Sys et al., 1991). ET of Kentucky bluegrass use crop coefficient of cool season grasses in golf course (Brown, 1987).

Table 1.1. Soil moisture content of sand growing media with 3 types of capillary rise interruption layer under saline condition.

Material for interruption layer	2009						2010								
	Summer			Fall			Spring			Summer			Fallz		
	Day after irrigation														
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
	(%)														
Gravel	7.5 a	5.3 b	5.0 b	6.1 b	5.5 b	5.6 b	8.3 b	8.0 b	6.2 b	6.6 b	5.3 b	5.6 b	6.5 b	6.3 b	5.9 b*
Coarse sand	7.9 a	5.6 ab	5.6 b	5.9 b	6.0 b	5.7 b	8.6 b	8.0 b	6.4 b	5.9 b	4.5 b	5.3 b	6.0 b	5.7 b	5.5 b
No layer	10.4a	8.0 a	7.3 a	8.1 a	8.7 a	8.8 a	11.8 a	11.4 a	9.1 a	10.6 a	9.0 a	9.8 a	8.7 a	8.5 a	8.7 a

* Means within a column followed by the same letter are not significantly different based on LSD.

Table 1.2 Calcium, magnesium and sodium contents of sand growing media with 3 types of capillary rise interruption layer under saline condition.

Material for interruption layer	2009		2010		
	Summer	Fall	Spring	Summer	Fall z
	Ca (ppm)				
Gravel	139.4 a	103.3 a	89.2 a	101.8 ab	130.3a y
Coarse sand	134.4 a	89.7 a	99.7 a	116.8 a	126.3a
No layer	105.3 b	99.3 a	78.2 a	87.7 b	111.3a
	Mg (ppm)				
Gravel	66.0 a	31.6 a	64.5 a	79.7 a	159.6a
Coarse sand	47.7 a	41.4 a	61.1 ab	59.9 a	172.7a
No layer	68.4 a	43.2 a	45.3 b	62.3 a	175.8a
	Na (ppm)				
Gravel	471.6 a	388.9 a	888.2 b	133.4 b	162.5a
Coarse sand	326.3 b	348.0 a	922.3 b	171.9 ab	119.6a
No layer	526.2 a	347.2 a	1064.0 a	241.1 a	189.9a

y Means within a column followed by the same letter are not significantly different based on LSD.
z Observed at the end of every seasons.

Table 1.3. The pH, electric conductivity (ECe) and sodium adsorption ratio (SAR) of sand growing media with 3 types of capillary rise interruption layer under saline condition.

Material for interruption layer	2009		2010		
	Summer	Fall	Spring	Summer	Fall [z]
			pH		
Gravel	6.47 a	6.91 a	6.71 a	6.25 b	6.57 c[y]
Coarse sand	6.50 a	6.79 a	6.58 b	6.41 a	6.82 b
No layer	6.30 b	6.62 b	6.61 b	6.54 a	7.06 a
			ECe (dSm^{-1})		
Gravel	3.3 a	2.5 a	4.8 b	1.75 a	2.69 a
Coarse sand	2.5 b	2.3 a	5.0 b	1.83 a	2.59 a
No layer	3.4 a	2.4 a	5.4 a	2.01 a	2.85 a
			SAR		
Gravel	11.9 ab	12.4 a	24.8 b	3.49 b	3.21 a
Coarse sand	8.9 b	10.8 a	25.5 b	4.62 ab	2.29 a
No layer	13.8 a	10.6 a	34.0 a	6.75 a	3.68 a

[y] Means within a column followed by the same letter are not significantly different based on LSD.

[z] Observed at the end of every seasons

Table 1.4. Kentucky bluegrass growth with various capillary rise interruption layer of growing media in saline condition.

Material for interruption layer	2009		2010		
	Summer	Fall	Spring	Summer	Fall [z]
			Visual quality [z]		
Gravel	8.3 a	8.2 a	8.1 a	8.4 a	8.3 a[*]
Coarse sand	8.2 a	8.3 a	8.1 a	8.4 a	8.1ab
No layer	8.0 a	7.9 b	7.9 a	7.9 b	7.8 b
			Clipping dry weight ($g\ m^{-2}$)[z]		
Gravel	13.84 b	6.04 ab	10.71 ab	19.09 a	10.49 a
Coarse sand	12.35 b	5.72 b	10.06 b	17.17 b	10.16 a
No layer	17.45 a	6.62 a	11.77 a	18.93 a	9.43 a
			Clipping fresh weight ($g\ m^{-2}$)[z]		
Gravel	-	22.29 b	34.79 ab	61.63 a	30.55 a
Coarse sand	-	20.39 b	31.86 b	54.34 b	29.17 a
No layer	-	28.73 a	39.66 a	64.24 a	28.30 a
			Leaf tissue water content (%) [z]		
Gravel	-	193.0 b	216.3 b	225.2 b	191.5 a
Coarse sand	-	191.2 b	208.8 b	219.6 b	187.7 a
No layer	-	237.2 a	232.2 a	240.2 a	200.2 a
			Root length (cm) [y]		
Gravel	10.0 a	16.1 a	19.3 a	21.3 a	34.5 a
Coarse sand	9.6 a	12.1 b	19.0 a	20.0 a	31.8 a
No layer	7.4 a	9.0 c	14.0 b	13.5 b	23.0 b
			Root dry weight ($g/100cm^{2}$)[y]		
Gravel	1.27 a	1.35 a	3.98 a	3.26 a	4.41 a
Coarse sand	1.51 a	1.67 a	3.42 ab	3.26 a	3.80 ab
No layer	0.64 a	0.80 a	2.47 b	2.55 b	3.25 b

[*] Means within a column followed by the same letter are not significantly different based on LSD.

[z] Average value from weekly data.

[y] Observed at the end of season.