오염지 토양에서의 대마 재배가 중금속 함량 변화에 미치는 영향

정미남, 문윤호, 오용비, 권병선[1)]
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Effect of Cultivation Hemp on Variation of Heavy Metal in Pollution Soil

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실험목적

대마재배에 의해 오염지 토양 개량효과를 구명하고자 함.

재료 및 방법

가. 공시품종 : 강원종

나. 공시토양 : 오염지토양(중금속, 축산폐수), 비오염토양(대비)

다. 재배법

구 분	파종일(월.일)	정식일(월.일)	수확일(월.일)	비 고
오염지토양	5. 22	5. 28	9. 6	Pot시험장소 : 온실
오염지토양+퇴비	6. 11	6. 17	9. 12	
축산폐수	7. 12	7. 19	9. 26	

결과요약

가. 식물체 부위별 중금속 함량은 Cd, Pb는 뿌리>줄기>잎, Zn은 뿌리>잎>줄기 순으로 많았다.

나. 중금속 오염지 토양 단독의 경우 대조구에 비해 현저한 생육 저해를 보였으며 「중금속 오염지 토양+퇴비」의 경우 비슷한 생육을 보였다.

다. 중금속 오염지 토양에서 중금속 감소량은 대마를 재배할 경우 Cd은 0.34~1.14

mg/kg, Pb은 18～28mg/kg, Zn은 47～73mg/kg으로 무재배지의 감소량 0.10～0.11, 4～9, 10～19mg/kg보다 더 많았다.

라. 축산폐수 오염지 토양에서는 대조구에 비해 조금 생육이 낮았으며, 시험전에 비해 유기물, 인산, 질소의 함량이 감소하였다.

Table 1. Comparisons of growth characteristics and dry matter yield of leaf, stem and root of hemp plant under four different soils.

Soils	Stem length(cm)	Stem diameter(mm)	Dry matter yield(g/pot)			
			Leaf	Stem	Root	Total
Non infected soil	174(100)	9.4(100)	35.4(100)	69.2(100)	11.8(100)	116.4(100)
Infected soil	81(47)	4.5(49)	3.9(11)	6.6(9)	2.5(21)	13(11)
non infected soil + Compost	193(100)	8.3(100)	37.0(100)	85.8(100)	15.8(100)	138.6(100)
Infected soil + Compost	182(94)	7.6(92)	28.0(76)	55.8(65)	9.7(61)	93.5(67)

Table 2. Changes of cadmium, lead and zinc in heavy metal from before experiment to after experiment on different soils. (unit : mg/kg)

Soils and cultivation	Cd			Pb			Zn		
	Before experiment	After experiment	Decrease	Before experiment	After experiment	Decrease	Before experiment	After experiment	Decrease
Non in fected soil	0.64	0.58	0.06	5.6	5.0	0.6	22.7	16.7	6
Infected soil									
Cultivation hemp	5.01	4.67	0.34	263	238	25	310	263	47
Non cultivation hemp	5.07	4.96	0.11	273	264	9	295	285	10
Non infected soil + Compost	0.65	0.61	0.04	5.9	5.0	0.9	71	59	12
Infected soil + Compost									
Cultivation hemp	6.26	5.12	1.14	230	18	18	382	309	73
Non cultivation hemp	4.17	4.27	0.10	286	4	4	409	390	19

Table 3. Comparisons of heavy metal content and absorption amount in different organ with leaf, stem and root of hemp plant.

Heavy metal	Plant organ	Non infected soil		Infected soil		Non infected soil + Compost		Infected soil + Compost	
		Content (ppm)	Absorption amount (㎎/pot)	Content (ppm)	Absorption amount (㎎/pot)	Content (ppm)	Absorption amount (㎎/pot)	Content (ppm)	Absorption amount (㎎/pot)
Cd	Leaf	24.9	0.88	30.8	0.12	25.9	0.96	27.5	0.77
	Stem	24.8	1.72	33.6	0.22	23.5	2.02	27.8	1.55
	Root	23.9	0.28	51.0	0.13	24.4	0.38	39.3	0.38
	Total	73.6	2.88	115.4	0.47	73.8	3.35	97.7	3.35
Pb	Leaf	205.0	7.28	205.8	0.79	207.0	7.66	211.5	5.92
	Stem	219.0	15.17	283.1	1.87	234.0	20.07	257.7	14.38
	Root	161.0	1.89	467.9	1.18	178.0	2.80	383.2	3.72
	Total	585.0	24.34	956.8	3.85	629.0	30.52	852.4	24.02
Zn	Leaf	166	5.9	1019	3.9	189	7.0	653	18.3
	Stem	139	9.6	939	6.2	117	10.0	347	19.3
	Root	195	2.3	1675	4.2	213	3.4	910	8.8
	Total	499	17.7	3633	1.4	519	20.4	1910	46.4

Table 4. Correlation coefficient of agronomic characteristics and heavy metal content in pollution soil.

Factor	Heavy metal content in before experiment(ppm)			Dry matter yield(g/pot)			Stem length(m)	Stem diameter(㎜)
	Cd	Pb	Zn	Leaf	Stem	Root		
Cd	-	0.449*	0.921**	-0.848**	-0.791**	-0.819**	-0.737**	-0.698**
Pb		-	0.516*	-0.558*	-0.544*	-0.379	-0.348	-0.414
Zn			-	-0.920**	-0.883**	-0.902**	-0.856**	-0.850**

Table 5. Correlation coefficient of agronomic characteristics and heavy metal content in pollution soil with plus compost control.

Factor	Heavy metal content in before experiment(ppm)			Dry matter yield(g/pot)			Stem length(m)	Stem diameter(㎜)
	Cd	Pb	Zn	Leaf	Stem	Root		
Cd	-	0.390	0.941**	-0.189	-0.142	-0.490*	-0.005	0.061
Pb		-	0.373	-0.210	-0.194	-0.323	-0.339	0.028
Zn			-	-0.381	-0.249	-0.550*	-0.158	-0.026

Table 6. Soil chemical properties of the experimental soil by ejected substance of animal and agronomic characteristics on hemp plant.

Experimental soil	Decrease rate	Stem length(cm)	Stem diameter(mm)	Organic matter(%)	Av. P_2O_5 (ppm)	NO_3-N (ppm)	NH_4-N (ppm)
Infected soil by ejected substance of animal	Before experiment	-	-	3.29	694	98.4	419.8
	After experiment	135	6.8	2.70	589	54.2	100.5
	Decrease rate(%)	-	-	18	15	45	76
Non infected soil	Before experiment	-	-	2.03	122	21.1	13.1
	After experiment	149	7.7	1.87	108	16.4	4.5
	Decrease rate(%)	-	-	8	11	22	66