

## SOIL SALINITY INDEX OF PLANTING SUNFLOWER IN SALINE-ALKALI SOIL

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### SUMMARY

Salinity of soil is a very important index to planting sunflower in saline-alkali soil. In this report, results of the experiment showed that sunflower is a crop with higher salt-tolerance. In this condition, the quantum of salt ions in soil is not more than 0.5 percent, we can gain some output so long as we adopt corresponding method of cultivation.

According to salinity of different parts of sunflower plant, salinity content of leaf blade is highest, in turn stem and floral disk and root is least. It may be seen from different parts of stem that salinity content of stem top is highest, in turn middle part of stem, and salinity of lower part of stem is least.

According to salt-tolerance of different development stages of sunflower, salt-tolerance of earlier stage of plant is lower, and later stage of plant is higher. It may be seen from different variety forms that salt-tolerance of local edible varieties is generally higher than exotic oil varieties. It may be seen from growth and development of sunflower, the higher salinity in soil is, the slower growth and development of sunflower are. For example, variety "Paradoveke", when quantum of salt ions in soil arrived to 0.0845 percent it need 8 days from sowing to emerging, and emerging rate is 95.7%; when the quantum of salt ions in soil arrived to 0.546 percent it need 17 days from sowing to emerging, and emerging rate is 87.3%. Another example, edible variety "Length Sunflower", when the quantum of salt ions in soil increased from 0.39 to 1.1 percent plant height reduced from 217 cm to 65 cm, diameter of head reduced from 14 cm to 1.5 cm.

West of Inner Mongolia (including plains of Hetao and Tumochuan) is arid and semiarid zones. Annual precipitation is about 200-400 mm, agricultural production principally rely on irrigation in large part of the area. Sunflower are principally planted those fields where salinization of soil is lighter. In order to know regularity of growth and development of sunflower in saline-alkali soil and increase yield of unit area, we made this experiment and investigation.

### MATERIALS AND METHODS

We used an oil variety "Paradoveke" and local edible variety and took saline-alkali soil from plants of Hetao and tumochuan, and sand soil without saline-alkali. It was mixed as proportion and made up different soil with levels of salinity. Then sunflower was planted in pot, bed and fields with soil of different salinity. We investigated the state of growth and development of sunflower and measured salinity in soil and in each part of plant.

### RESULTS AND DISCUSSION

Results of the experiment showed that sunflower is a crop with higher salt-tolerance. As quantum of salt ions in soil is not more than 0.53 percent on oil variety "Paradoveke" and not more than 0.59 percent on edible varieties, we can gain some output so long as we adopt corresponding methods of cultivation. Table 1 indicated the results of germination test of sunflower in pot with saline-alkali soil.

According to results in Table 1, days that seeds of sunflower were from sowing to emerging were increased from eight days to seventeen days with increasing of salinity in soil. But emergence rate was reduced and seeds of sunflower didn't even germinate with increasing of salinity in soil. It may be seen from

salt-tolerance at different stage of development of sunflower that salt-tolerance of saunflower is lighter in earlier stage of plant groeth in later stage of plant growth. According to the experiment of Bameng institute of agricultural sciences (1980), plant of "Paradoveke" grew normally when total salinity of soil was 0.18% in emergence stage; when salinity increased to 0.47% plant of "Paradoveke" was severely retarded; as soil salinity increased to 0.76% plant was damaged to die. In period of floral initiation, plant of this variety grew normally when salinity of soil is 0.35%; plant was severely retarded when salinity of soil increased to 0.70%; plant was damaged to die when salinity of soil increased to 0.85%. A similar trend was indicated in salt-tolerance of edible varieties in all stages of growth and development too (see Table 2).

Table 1. Germination effect of sunflower planted in saline-alkali soil

Total quantum of ions in soil %	Cl <sup>-</sup> %	Var. "Paradoveke"		Var. "Sandaomei"	
		Sowing--Emergence rate	Emergence rate	Sowing--Emergence rate	Emergence rate
		Days	%	Days	%
0.0845	0.0106	8	95.7	8	93.3
0.1645	0.0264	9	94.7	9	82.0
0.2760	0.0951	10	95.0	11	93.3
0.5460	0.0608	17	87.3	17	75.3
0.9492	0.1776				

Table 2. Salinity in soil from 0 to 20 cm in period of development and growth of sunflower

Variety forms	Degree of effecting	Salinity in soil %			
		Emerging Period	Floral initiation Period	Flowering period	Maturing period
Oil var. "Paradoveke"	Severely	0.76	0.85	0.86	1.06
	Retardation	0.47	0.70	0.77	0.87
	Effect	0.33	0.46	0.51	0.62
	Normally	0.18	0.35	0.35	0.53
Edible v. "Length sunflower"	Severely	0.81	0.89	0.88	1.13
	Retardation	0.62	0.74	0.78	0.96
	Effect	0.35	0.60	0.68	0.69
	Normally	0.22	0.44	0.48	0.59

According to relationship between growth of sunflower and soil salinity, the higher soil salinity is, the slower growth and development of plant are (see Table 3).

Table 3. Effect of total salinity of soil on growth and development of sunflower

Var. forms	Variety	Degree of plant damaged	Period of plant damaged	Plant height (cm)	Number of leaf blade	Diameter of head (cm)	Grain weight of plant (g)	100-grain weight (g)	Total salinity of plant (%)	Total salinity of soil (%)	Cl <sup>-</sup> ion in soil (%)	Dry matter weight of plant (g)
Oil var.	"897"	Death	floral initiation	16	18	1.0	0	0	14.00	1.08	0.1846	35.4
		Retardation	Flowering fall	98	26	17.0	64.2	5.75	16.10	0.47	0.0895	243.6
		Effect	Bloom	140	30	14.0	66.7	6.35	12.54	0.37	0.0770	578.5
		Normally	Bloom	178	30	17.0	73.9	6.30	11.60	0.28	0.0540	733.8
Edible var.	"Length sunflower"	Death	Floral initiation	65	34	1.5	0	0	11.60	1.10	0.2336	175.6
		Retardation	Floral expansion	130	33	7.0	140.0	12.2	9.46	0.67	0.1448	620.5
		Effect	Flowering initiation	203	37	9.0	153.5	13.4	10.24	0.56	0.1278	1124.0
		Normally	Bloom	217	37	14.0	160.4	13.4	9.28	0.39	0.0817	1355.0

According to Table 3, salinity of soil increased to 1.08% from 0.28%, plant height of oil variety reduced from 178 cm to 16 cm, diameter of floral disc reduced from 17 cm to 1.0 cm. Similarly, when salinity in soil increased to 1.10% from 0.39%, plant height of edible variety reduced from 217 cm to 65 cm, diameter of disc reduced from 14 cm to 1.5 cm. Plants that was planted in soil with high

salinity were dead in period of floral initiation. But plants that grew normally had come into period of full bloom.

It can be seen from salinity of different parts of sunflower plant that salinity of leaf blade is highest, stem and disc of sunflower is second, salinity of root is least. It can be seen from different parts of stem that salinity of top of stem is highest, middle part of stem is second, salinity of lower part of stem is least.

According to the experimental results, the safe critical level of salt-tolerance of local edible variety of sunflower is from 0.22% to 0.35% in period of emergence, 0.44% to 0.60% in period of floral initiation, 0.48% to 0.68% in flowering stage, 0.59% to 0.69% in maturity stage. The safe critical level of salt-tolerance of oil variety ("Paradoveke") is from 0.18% to 0.33% in stage of emergence, 0.35% to 0.46% in floral initiation, 0.35% to 0.51% in flowering stage, 0.53% to 0.62% in maturity stage. Generally, plant of sunflower will be retarded or damaged to die by saline-alkalinity if salinity of soil is in excess of this critical level in every period of growth and development of sunflower.