PRIMARY MEASURES OF CULTIVATION OF SUNFLOWER IN SALINE-ALKALI SOIL

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ABSTRACT

Sunflower is a crop with higher salt-tolerance. When the quantum of salt ions in soil is not more than 0.5 percent, we can gain some yield and increase survival rate of seedling so long as to adopt corresponding measures of cultivation. Primary measures of cultivation of sunflower as follows:

1. Ploughing land and irrigation for clearing away salinity of soil.
2. Selecting varieties with salt-tolerance and hybrids.
3. Taking good care of sowing.
   1) Sowing in furrow.
   2) Seed soaking with water of suitable temperature.
   3) Deep furrow drilling and shallow covering soil.
   4) Cultivation technique of soil covered with plastics film.
4. Management of field
   1) Weed clearing early and preventing movement of salinity up to surface layer of soil for increasing survival rate of seedling.
   2) Reasonable irrigation for protecting seedling from death.

INTRODUCTION

West area of Inner Mongolia belong in arid and semiarid zones. Annual precipitation is about 200--400 mm. Annual evaporation capacity is about 2000--2500 mm. Because irrigation come largely from "Yellow River", hence level of ground water is so high that salinization of soil become very serious. Salinity in soil salinized has itself rule of movement with different seasons of growth. Salinity of soil in plough layer decreased when we had irrigation in seasons of growth and plough after harvest; it is steady in winter and moved up to surface layer of soil with movement of water when the weather become warm and temperature of ground increase in spring. At the same time, because there are windy, evaporation capacity is high in the area, salinity of soil cumulated in plough layer, especially surface layer of soil. According to rule of movement of salinity of soil, how effect measures for decreasing salinity of soil and raising survival rate of seedling are adopted is a very important road for increasing yield of unit area. Around this problem we made several experiments for research.

MATERIALS AND METHODS

We selected 60 varieties (including hybrids) introduced from abroad and adjusted into solutions of different concentration with extracting solution of saline-alkali soil for germination test. At the same time, we arranged experiment in field for selecting varieties with higher salt-tolerance and hybrids. Field was carefully prepared after ploughing. We installed deep irrigation and shallow irrigation as compared with nothing of any irrigation. Then we measured salinity of soil and survival rate of seedling of sunflower.

Sowing technique:

1. Infusing seed comparision with nothing of any infusing.
2. Deep sowing with shallow covering soil, deep sowing with deep covering soil and shallow sowing with shallow covering soil.
3. Plastics film was used for covering land as compared with plastics film was not used so that we would research effect of covering with plastics film.

Management of field:

1. Cultivation in emerging period, cultivation at 6--7 paires of leaf and cultivation as plant height was 30 cm.
2. Irrigation test in period of growth.

RESULTS AND DISCUSSION

Principal measures of planting sunflower in saline-alkali soil:

1. Ploughing land and irrigation for exclusion salt. Land should be ploughed at once after harvest. Then we had irrigation so that salinity of plough layer was decreased. In seasons of winter and spring, land was harrowed for holding moisture, preventing and reducing rising of salinity of soil so that sunflower can be planted in this field.

2. Selecting both variety and hybrid with higher salt-tolerance. Now varieties used in production of sunflower in Inner Mongolia are principally oil variety "Paradoveke" and local edible varieties. According to our experiments, salt-tolerance of oil variety introduced from abroad is weaker than local edible variety. According to valuation of salt-tolerance of different varieties and hybrids, varieties selected and hybrids from Hetao and Tumochuan areas have high salt-tolerance, emerging rate and survival rate of seedling. For example,"Nei 80--5", edible variety in Linhe, "San Dao Mei" in Tumochuan and "Nei Kui Za 1", etc.

3. Sowing technique:

1) Sowing in furrow as some distance.

According to rule of movement of salinity in soil, salinity of soil was cumulated in surface of soil. Therefore, we open furrow before sowing and put seeds in bottom of furrow or adopt method of hole seeding.

2) Seeds of sunflower need to absorb water for germination. Salinity enter inside of seed while seed absorb water. The higher salinity of soil is, the more salinity entered inside of seed is. Seed of sunflower will lose capacity of germination when salinity in seed cumulate up to some content. In order to reduce salinity in seed, seed is infused in water of 30--35 degree centigrade before sowing so that seed germinate early for emerging and reduce harm of saline-alkali.

3) Seed was deep sowed in furrow and covered shallowly with soil (about 3 cm). Salinity in surface layer of soil have a trend reduced from surface layer to sublayer in spring. Seed was sowed in the soil with less salinity after furrowing and it is of benefit to uptake water for germination. But soil covered can't be so thick that seedling is etiolated and don't appear.

4) Cultivation technique with covering of plastics film: We cover soil with plastics film after sowing for planting sunflower in saline-alkali soil. It may prevent rise of salinity upward surface of soil and raise survival rate of seedling. Primary effects with plastics film are as follows:

(a) Evaporation of moisture was prevented and reduced so that salinity in surface layer of soil was decreased and survival rate of seedling was raised. It forms a small place between surface of ground and plastics film after covering with plastics film. Exchange of moisture was cut off between soil and surface on ground. A large circle of moisture was damaged between soil and atmosphere. Moisture from evaporation of soil and evaporation from vegetation was stored in place under plastics film. A small circle of moisture between soil and plastics film was set up again. Such a result, moisture content of soil in plough layer preserve a relative steady atate. According to the experiment of Huang Shiquan (1983), mean moisture content from 0--20 cm in soil was 24.6% when soil was covered with plastics film from April 17 to May 17. Moisture content without plastics film was 23.4%. Moisture content with film was 1.2% more than that without film. But moisture content of ck reduced 0.1%. Effect of holding moisture is best in layer of 0--5 cm. Soil moisture content with plastics film was 22.1% and ck was 19.6%, difference value between with film and vithout film was 2.5%.

Salinity of soil concentrate rapidly upward surface of ground with large loss of moisture in soil. Especially bed of seed in soil of 0--5 cm, soil salinity of ck was most, it was 2.23 times as much as that of covering of plastics film. Salinity in other layer of soil was also 1.40--1.65 times as much as that of covering with plastics film. Mean salinity of soil was 1.8 times as much as that of covering of plastics film. Not only was evaporation of soil moisture reduced but also rise of salinity of soil was controled after covering of plastics film. Salinity cumulated in soil reduced overagely 0.149% less than that before sowing and reduced 0.2ll% less than that of ck. Exchange of salinity in arable layer of 0--5 cm was very large. Salinity of soil reduced 0.199% less than that before sowing. But salinity of soil to ck increased 0.332% higher than that before sowing. Therefore, survival rate of seedling of sunflower may be increased to 20% with covering of plastics film for cultivation of sunflower.

(b) that we used plastics film for cultivation of sunflower may generally raise temperature of soil as 2°C. In this condition, period of emerging was 8 days earlier than that without plastics film, period of floral initiation and flowering was 9--11 days earlier than that without plastics film. Sunflower of cultivation with covering of plastics film has a very dominancy of growth before covering row. Effect of increasing temperature with covering of plastics film decreased gradually and was even negative value after covering row.

(c) After covering of plastics film, rainfall in spring can't directly enter root of sunflower. Large soluble salt in surface of soil avoid solution so that rate of emerging and survival rate of seedling is raised.

4. Management of field.

1) We should cultivate early for clearing weeds and protect seedling from harm of saline-alkali. Capacity of resistant saline-alkalinity of sunflower is weak in stage of seedling. Therefore, cultivation for destroying capillary tube of soil in time in period of emerging and preventing rise of salinity all are major measures for all of seedling and survival rate of seedling. Primary methods are to weed after emergence and to clear away saline-alkali surround seedling.

2) Reasonable irrigation for preventing seedling from death. Root of sunflower is not only large and deep but also it's distribution is wide. So it may absorb water in deep layer of soil. There are dense white villus on stem, it may decrease evaporation of water. There has full of spongy tissue in stem, it can store a lot of water so that sunflower has strong capability of resistant drought. According to our experiment, if sunflower grow normally, we needn't to water when blade didn't come about wilting. We may water if growth and development are retarded by drought. But we require to water largely and quickly and to drain superfluous water away. If we water slowly and shallowly, plant will die early becouse salinity of soil surface melt in water, it may raise salt concentration in soil. If we water in stage of high temperature of growth, it may make salt melt rapidly in water so that sunflower will die rapidly by absorbing extra water with salt.