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Salt Transfer Law for Cotton Field with Drip Irrigation Under The Plastic Mulch in Arid Zone

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Abstract

Salt transfer law for cotton field with drip irrigation under the plastic mulch was analyzed from two aspects: different postemergences and different direction (vertical direction and horizontal direction). The results show that with the retardation of postemergences, the accumulation of salt in 0-50cm soil layers decrease in different extent. The accumulation of salt in vertical direction increase at the soil layers from 50 to 70cm, but the one at the soil layers from 70 to 90cm change a little. The accumulation of salt in horizontal direction at the narrow row is more than any other position and the one under the emitter is least.

Index Terms: Drip irrigation under the plastic mulch; salt transfer; arid zone

1. Introduction

Soil salinization is the accumulation of soluble salt in the soil to achieve the level of harmful plants(salinity greater than 3-6g/kg the majority of the growth of cultivated plants would be affected).Occurrence of various soil salinization and alkalization processes are known as saline soil, including saline, alkaline earth, and all kinds of salinization of soil, alkaline soil.Currently, land salinization has become a global problem.Saline soil cultivated in all continents were distributed in recent years the area expanded rapidly, growing degree of salinity, especially in big demand for irrigation water, drainage, and can not be effectively irrigated arid and semi arid areas is more serious[1,2]. Soil salinization has become the oasis of the main obstacles to the development of agricultural production factors[3-5].

To further tap the production potential of Oasis, the development of agricultural production, water-saving irrigation is the only way oasis. Oasis in Xinjiang to promote the fastest and largest water-saving irrigation technology is the drip irrigation technology, compared with the general surface irrigation can save water by 40%-50%,an increase of 20% to 30%, and the terrain adaptability water use efficiency is the highest. However, drip irrigation technology,the emergence of new oasis farmland soil secondary salinization. Saline drip irrigation technology is a continuous supply of small scale, easy to drive away salt from the root to the lateral and deeper soil layers, drip irrigation does not produce as deep penetration is difficult to use irrigation water

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leaching salts, salt only in the soil and can not be eliminated, the trend of salt did not change; drip irrigation channel system eliminates the field, soil contiguous planting, removing alkali drainage lost, the objective contribute to groundwater level rise, which prevent soil salinization very unfavorable. Thus driving under drip irrigation can only solve the problem of salt, so that the formation of salt water down topsoil layer, short crops to ensure normal growth and development, and salt accumulation of soil desalinization and the persistence of this conflict[6,7].

In view of this, combined with the actual production to test for basic research Drip cotton soil salinity migration law in order to control secondary salinization provide the necessary scientific basis.

2. Material and methods

A.. Test Area Overview

Field test point locates in Irrigation Experiment Station of Bazhou water resources management division. The location is 41°35′-41 °37′N, 86 °09′-86 °12′E,at an altitude of 895-903m.Test district belonged to warm temperate continental desert climate,annual precipitation 53.3-62.7mm,focused on June to August. The average years of evaporation 2273-2788mm (20cm diameter pan evaporation observations), average relative humidity of 45-47%, annual average temperature is 10.5℃,the summer heat, extreme maximum temperature of 43.6℃,less snow in winter cold,average temperature in January -9.4℃.Mainly sunny the whole year,long sunshine hours,solar radiation 633KJ,temperature difference between day and night. Annual average sunshine hours 3036.2h,more than 10℃ accumulated temperature 4285℃,annual average frost-free period 188d.

Experimental field with drip irrigation systems,drippers spaced 30cm,drip irrigation with a spacing of 1.5m, the design working pressure of 0.1Mpa, emitter flow rate Q=3.2L/h, Ditch irrigation water salinity 1.0-1.1g/L trial in November 2007 were winter irrigation,irrigation amount was 2250m3/hm2,irrigation mode is flood irrigation. Cotton varieties is Xinluzhong 21,the growth period of 133-136d. Coated cotton cultivation mode as "one film four lines", Spacing is:20+40+20cm(see Figure 1),film width 125cm, width of the actual cover to 110cm, Previous Crops for cotton.

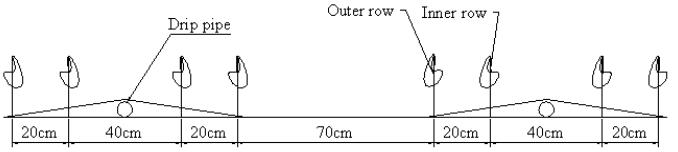

Fig.1 Planting pattern of cotton

B. Study Scope and Methodology

Experiment starts in 2008 during the seedling(June 21), bud stage(June 25),the flowering period (July 16),boll stage (August 11) and vomiting period (September 5) determination of 0-90cm soil depth of the soil salinity. In the horizontal direction away from the drip zone 0cm (also known as the central line width), 20cm, 30cm (also known as narrow-line central),40cm,50cm, 70cm (also known as film companies) a total of six sampling points, take soil samples, in Each point of the vertical direction in accordance with the 0-10cm,10-20cm,20-30cm,30-50cm,50-70cm,70-90cm in the levels of excavating soil samples, a total of six levels of 36 soil samples were removed, the sampling diagram in Figure 2. During the first sample, do a fixed mark, after which each sample were removed and fixed office.

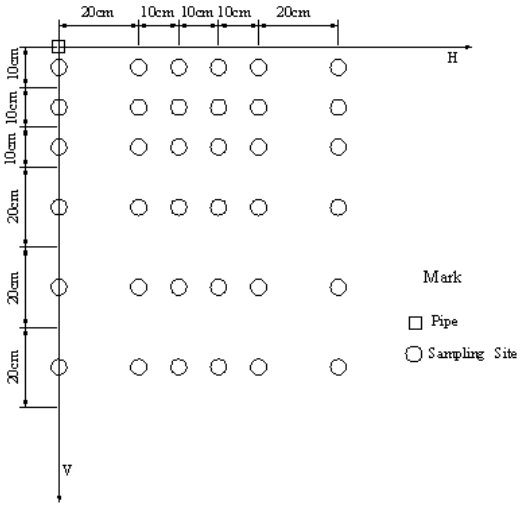

Fig 2 Distribution of the sampling point

Determination of soil samples by drying the soil moisture content. Meanwhile,the dug-like air-dried soil after grinding through 1mm screen, follow the 1:5 ratio of soil water extraction, extraction solution after the extracts were measured by electrical conductivity electrical conductivity (due to soil salinity and leaching a linear relationship between electrical conductivity, this paper is to extract electrical conductivity to characterize the soil salinity). Cotton by the test results of drip irrigation conditions, soil salinity at different growth stages of the distribution of horizontal and vertical direction.

3. Results and Analysis

In this paper,irrigation quota 4500m3/hm2(excluding winter irrigation water), irrigation treatment cycle 7d example, from the cotton under drip irrigation at different growth stages and in different directions (vertical and horizontal) both in terms of soil salinity migration analysis.

A. soil salinity changes characteristics with different growth in vertical direction

Different soil salinity variation with the growth period (see Table 1), the overall trend is the first drop of water salinity in the soil before the larger, of which 0 to 50cm soil layer contains the largest salt, with the growth stage postponed, each layer of soil salinity has increased to varying degrees.When dripping began, because of water leaching to the surface soil salinity decreased gradually after entering the cotton boll stage branched flourished in largely reduced soil moisture evaporation, then reduce the aggregation of the surface soil salinity. By the end of August early September after cutting off water surface soil salinity has increased gradually, and salt and drip irrigation water corresponding to that is dripping with low salt content of soil, or on high, fully reflects the production of "salt With the water action "features.

B. soil salinity changes characteristics with different growth in horizontal direction

Horizontal salinity variation with the growth period (see Table 2). With the growth of the push, the horizontal direction 0-40cm soil salinity decrease to varying degrees, in the desalination zone; horizontal direction 40-70cm of soil salinity has increased in the state, as salt accumulation zone and 40-50cm Department especially salt accumulation phenomena.

Table I . Soil salinity at different growth stages in cotton field at vertical direction ms/cm

Growth period	Soil depth/cm					
	0-10	10-20	20-30	30-50	50-70	70-90
Seedling	1.627	1.485	1.267	1.064	1.162	0.946
Bud stage	1.08	1.152	1.124	0.843	1.243	1.132
Florescence	0.784	0.914	1.14	0.891	1.494	1.23
Boll stage	0.72	0.921	1.103	0.854	1.552	1.184
Vomiting period	0.768	0.887	1.095	0.907	1.547	1.198

Table II. Soil salinity at different growth stages in cotton field at Horizontal direction ms/cm

Growth period	Horizontal direction/cm				
	0-20	20-30	30-40	40-50	50-70
Seedling	0.847	1.036	1.254	1.515	1.379
Bud stage	0.798	0.955	1.176	1.673	1.534
Florescence	0.665	1.037	1.029	1.712	1.596
Boll stage	0.724	1.163	1.07	1.688	1.583
Vomiting period	0.738	1.034	0.985	1.774	1.607

C. Vertical variation of different soil salinity

When the first soil moisture close to saturation, and then slowly spread to four weeks to form infiltration of a semi-conical body (that is moist peaks). Soil water movement and salt leaching in tandem to the edge of invasion in vitro, act as a "drive salt" effect[8], so that the main root zone of soil formation of a low salt zone or dilution zone. One vertical salinity at different depths the measured results shown in Figure 3, can be seen from Figure 40cm to 50cm soil salt content is relatively low, because under the dripping water continuously during the period under the drip emitter, so that the layer higher soil moisture keeping the lowest salt content due to Er Shi, the salt water down areas, but invasive in vitro with the drip edge of the salt diffusion slowed down and gradually accumulated in the outer edge of the soil, so you can see 50-90cm soil layer in the accumulation of more salt so, on 50-70cm soil layer of salt accumulated up to that drop of water in the infiltration of salt into the wet zone during the process of aggregation of the bottom layer,but in 50-70cm and 70-90cm The accumulation of salt found in soil gradually decreasing another state, it can be speculated that 50-70cm soil layer is the salt of the largest gathering area,70-90cm soil layer has little effect on salt transport under drip irrigation, 30-50cm soil is most affected by drip irrigation on salt transport in most residential areas and the transition zonebetween.

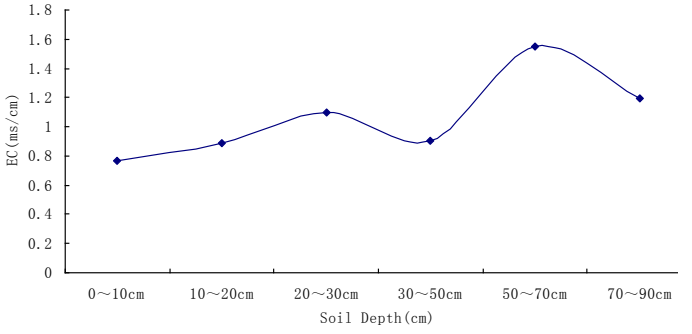

Fig.3 Vertical 0 to 90cm soil salinity variations

4. Conclusion

A) Salt with the water moving,as in the moist membrane in vitro under the narrow margin of the lateral

line(the horizontal direction near 40-50cm),resulting in areas where soil salt accumulation is not our traditional concepts of soil salt accumulation in the membrane area.

B) In cotton at different growth stages, the distribution of salt throughout the soil profile is always in a dynamic process:(1) Film and salt with the vegetation coverage rate increased, the fundamental does not change after flowering;(2) Membrane under the narrow row lateral (horizontal direction near 40 to50cm) is always in the process of salt.

C) For different conditions of soil texture, capillary laying a membrane to be used according to local conditions one or a film two ways:in the clay or partial clay soil conditions, as water levels greater than vertical migration from the migration distance, it can be with the layout of a film one way;in sand or sandy soil conditions,partial, because the horizontal transport of moisture away from the less than vertical migration, it can be used in the layout of a two way membrane.

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