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THE STUDY OF IRRIGATED MODEL OF COMPREHENSIVE UTILIZATION OF BRACKISH WATER AND FRESH WATER VIA FIELD EXPERIMENTS

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ABSTRACT A severe situation regarding water diversion from the Yellow River has reduce water resources by 25% creating a lack of fresh water, the development and utilization of the brackish water is the one of the important ways to ensure that industrial and agricultural production has a healthy future in Hetao Irrigation Area. It is of great theoretical significance and application of these values are necessary to develop agriculture and to by exploring ways of utilizing salt and fresh water irrigation methods which are suitable for Irrigation of the Hetao area without affecting the favorable cycle of associated to the regional environment. In this study, the irrigated areas of the Hetao Hongwei testing ground in Inner Mongolia were considered as the research subject. Irrigation experiments that alternate salt and fresh water are applied and the studies carried out. Studies have shown that during the growing cycle of crops salt accumulation in the root layer with brackish water for irrigation is more important that with fresh water when performed before the following sowing season. It has also been noticed that through a well-developed drainage system combined with irrigation from the Yellow River fall water, soil salt will return levels of the last sowing season. The salt levels of the crop root zone layer achieve equilibrium within a year, and it was found that the brackish water irrigation has little influence on crop height and yield.

Keywords : Brackish water Irrigation model Rotation irrigation Field experiment
Hetao Irrigation Area

1 Pilot program

The spring wheat is the test crop. Plot experiment's area is 2m × 3m. For 2008 year is the wet-year, brackish water irrigation has set up 3 times. The first irrigation is on May 17, in which wheat is in the seedling stage, the fresh water irrigation is used. The salinity of water is 0.732g / l .It turns to use brackish water which the salinity is 3g / l to irrigate on June 9 and June 26. All the irrigating quota is 60m³ / acre. Comparative field is irrigated by the Yellow River water. Irrigation quota is 60m³ / acre. Soil water and salt is tested in

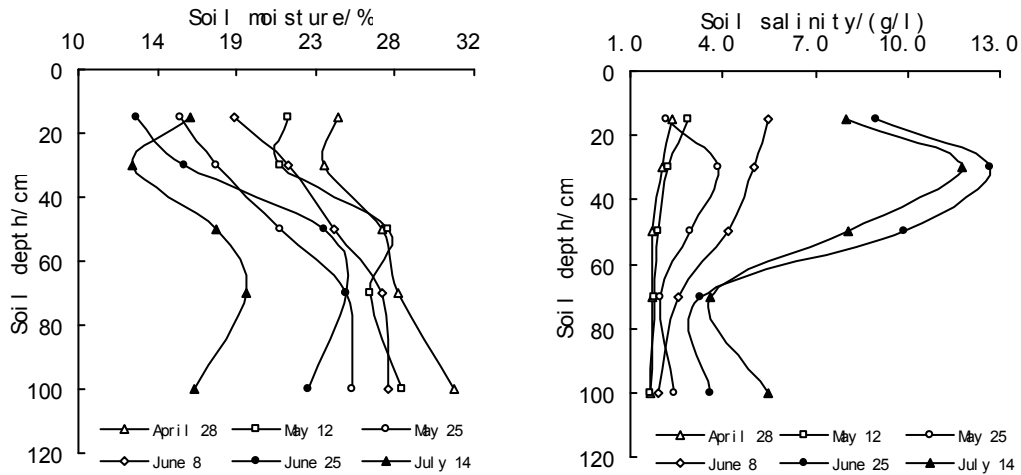
* Fund project: Inner Mongolia government funds projects (The study of water environment monitoring assessment and prediction in water-saving transformation project area of Hetao irrigation area of Inner Mongolia)

methods of field segments before and after each irrigation. The depth of sample is 100cm, which is divided into 5 layers: 0-15cm, 15-30cm, 30-50cm, 50-70cm and 70-100cm. The plant height and yield is observed

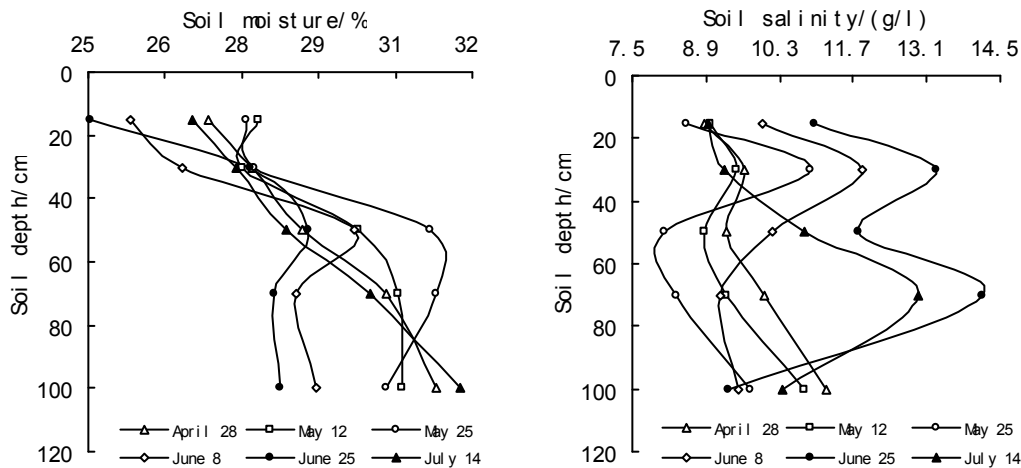
2 The analysis of test results

2.1 The migration law of water and salt

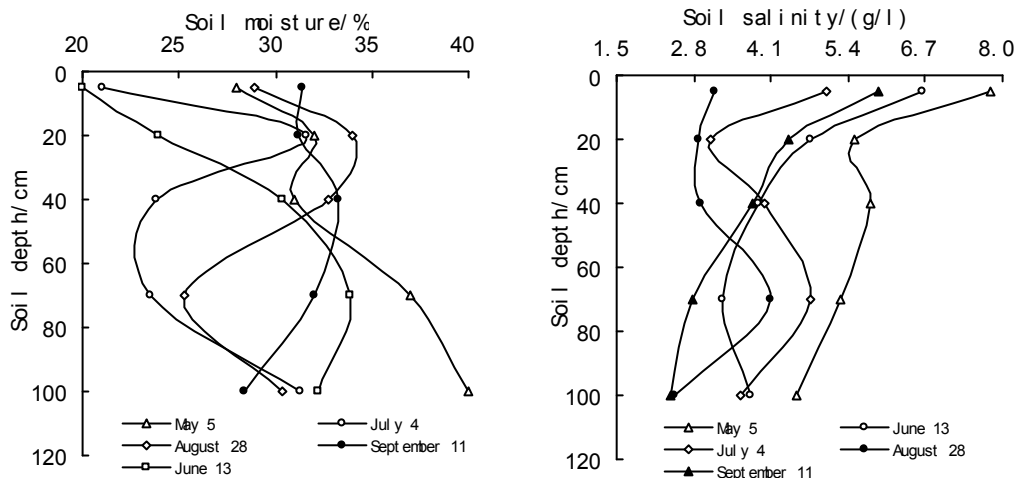
Figure 1 shows the [observed values](#) of moisture and salinity of all [soil samples](#) in each experimental field.



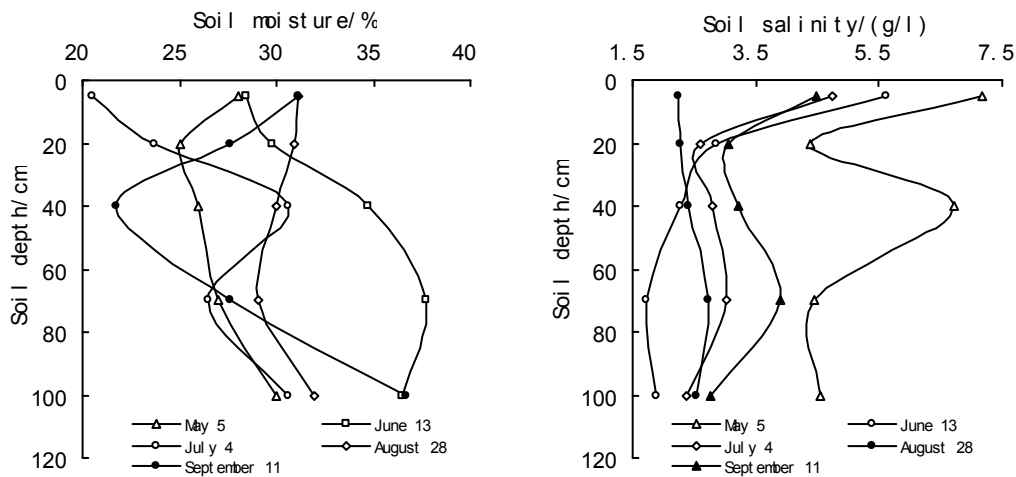
experimental field 1



experimental field 2



(c) experimental field 3



(d) Comparative field

Fig. 1 The dynamics of Soil Water and Salt in experimental field

The salinity profiles of figure 1 (a) shows the salinity in experimental plot 1 before the first irrigation on April 28 and May 12. The tendencies of change between these two dates are uniform. There is no rainfall and irrigation during this period. Soil salinity gathers to the surface in response to evaporation, which results that the surface salinity is high during this period. Moreover, with the elapse of time, salinity gathers up more seriously. Therefore, the soil salinity on May 12 is slightly more than on April 28. After the first irrigation on May 17, the salt on May 25 shows that surface salinity decreases. Salt transfers downward with water, which achieves to the maximum in the depth of 30cm, then it continues to downward and reduce gradually. Between May 25 and June 8, there is no irrigation and rainfall, the salinity transfers upward with the strong evaporation, Soil salinity of each layers changes much greatly on June 8. After the brackish irrigation on June 9, the soil salinity is obviously addition on June 25. For one

reason is that we retrieve samples after a longer period since irrigation, and it is only a small rainfall in the meantime. The salt transfers and redistributes in the soil after the irrigation, which is moving up with strong evaporation. For another reason is that it is irrigated with the brackish water, which makes the soil salt increased. After another brackish irrigation on June 26, above 70cm soil salt on July 14 reduces over June 25, with great rainfall once during this period,

The change of soil salinity in the experimental plot 2 is basically the same as the experimental field 1 as shown on the figure 1 (b). The difference is that the two experimental field are arranged in different areas. Because basis salt of the soil is different (that in area 2 is higher than that in area 1), the soil salt of area 2 is more than area 1 on the initial April 28 and May 12, then the change is the same basically.

The figure 1 (c) and figure 1 (d) are the soil water and salt of experimental field 3 and the comparison field respectively. There is no irrigation before May 5 and less rainfall. In addition to the heavy accumulation of salt on the surface, the salt of the experimental and the comparison field mainly gathers in the department of 40cm. When we irrigate on May 12 and May 29, as a result of the leaching, the salt of the whole soil profile are less than the initial on June 13, but the irrigation at experimental field is saltwater on May 29, the reduction of the soil in experimental plot is less than that in the comparison fields. After the irrigation on June 29, the profile on July 4 shows that the salinity of soil transfers downward with water, the salinity on the surface decreases and gathers at the depth of 70cm. Between July and August, the rainfall is high. The distribution of salt on August 28 shows that the entire section salt is reducing. From the end of August to the early September, it is not irrigated and the rainfall reduces. As the soil salinity profile on September 11 shown, the salt transfers upward in response to evaporation.

The salinity of soil changing with the time in the figure 1 (c) (d) shows that the salinity of soil in the study area is in the downward trend from May 5 to August 28, as the result of irrigation and rainfall. The salinity of soil transfers upward as rainfall reduces on September. The figure also can show that the salinity of the experimental field is mostly higher than that of the comparison field through the whole profile. The weighted average salinity of different times and different salt layer compares in the experimental field and the comparison field, it also can prove that result, the results compared is in Figure 2.

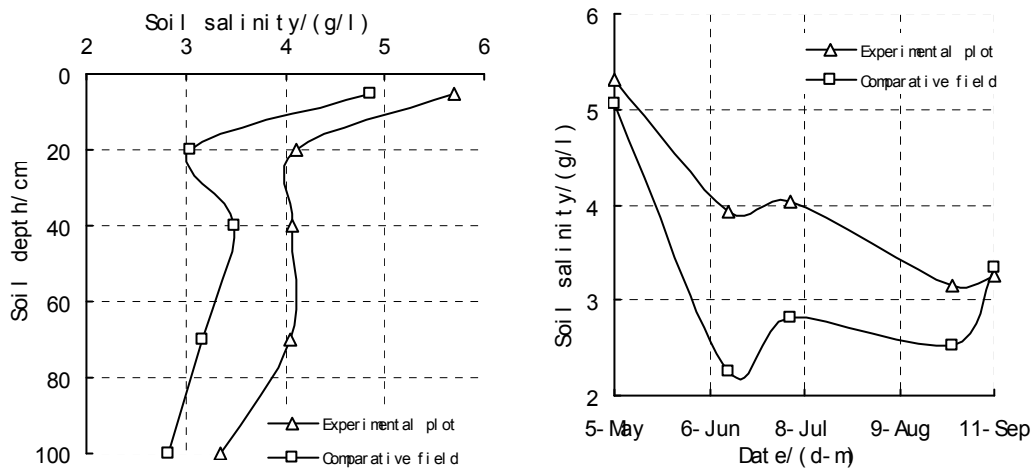


Fig. 2 The soil salinity contrast of the experimental field and the comparison field

2.2 Change of crop growth and yield

The figure 3 is the contrast map of spring wheat height between the experimental field and the comparison field. It shows that the height is little difference. The spring wheat production of the experimental field is 313kg / acre, and that of the comparison fields 328kg / acre, so the difference of yield is puniness too.

Figure 3 The comparison of spring wheat plant height

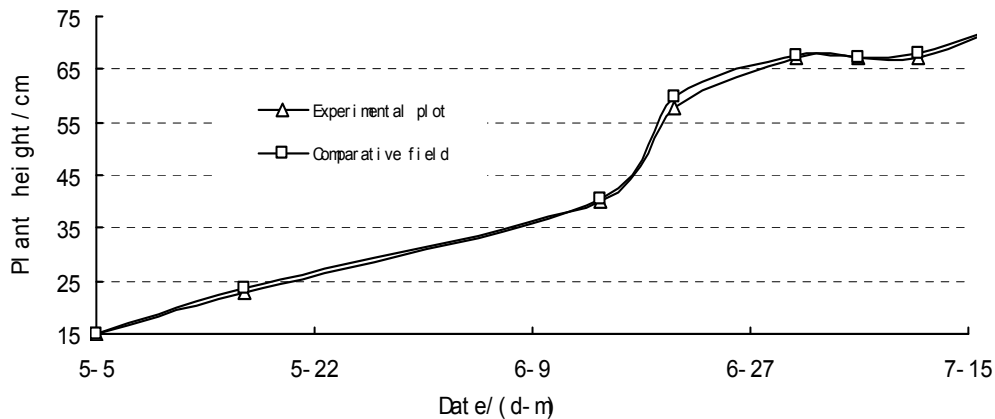


Fig. 3 The contrast of spring wheat plant height

3 Discussions

From the above analysis, it shows that salt accumulation in the root layer during the crop growing under the "light-salty-salty" irrigation mode is more than that under the fresh water irrigation, while when it will not harm crops unless it exceeds the crop limits of

salt-tolerant, after the irrigation in fall, the salinity of soil flows down with the large-scale water, the salinity of root layer decreases significantly. Then with the evaporation strengthened, the salt rises again. Before the following sowing season, the salinity of soil can recovers to the level of the previous sowing season basically. The salinity of crop root reaches to balance within a year, shown in Figure 4.

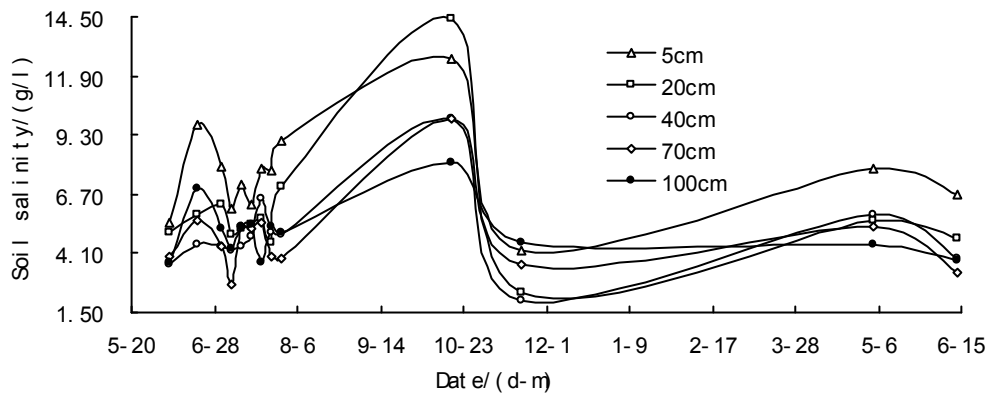


Fig.4 The soil salt of the root croplayer within a year

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