刘小京简历

A、EDUCATION

Ph. D., Agricultural Chemistry/Agronomy. 2006. Tokyo University of Agriculture., Tokyo, Japan. Dissertation: **Influence of Moisture Status of Soils and Nitrogen and Phosphorus Nutrition on Salt Tolerance of a Halophyte Plant *Suaeda salsa* (L.) Pall.**

M. Sc., Plant Nutrition/Agronomy. 1991. China Agricultural University, Beijing/ Shijiazhuang Institute of Agricultural Modernization, Chinese Academy of Sciences. Thesis: **Effects of Nitrogen, Phosphorus and Potassium on the Growth, Development and Seed Cotton Yield of Short-Season Cotton**.

B. Sc., Agronomy. 1988. Hebei Normal College of Agricultural Technology, Changli, Hebei Province.

B、PROFESSIONAL EXPERIENCE

Aug. 2006-present Professor of Center for Agricultural Resources Research, Head of Nanpi Eco-Agricultural Experimental Station, Institute of Genetics and Developmental Biology, Chinese Academy of Sciences.

March 2007-June 2007 Visiting Professor of University of Tokyo, Japan.

Nov. 1997-Jul. 2006 Associate Professor, Head of Nanpi Eco-Agricultural Experimental Station, Center for Agricultural Resources Research, Institute of Genetics and Developmental Biology，Chinese Academy of Sciences.

Nov.-Dec. 2005 Visiting Scholar at Tokyo University of Agriculture

Nov.-Dec. 2003 Visiting Scholar at Tokyo University of Agriculture

Aug. 1996-Oct. 1997 Assistant Professor, Head of Nanpi Eco-Agricultural Modernization, Shijiazhuang Institute of Agricultural

Modernization, Chinese Academy of Sciences.

Dec. 1995-Jul. 1996 Assistant Professor of Shijiazhuang Institute of Agricultural Modernization, Chinese Academy of Sciences.

Jul. 1994-Dec. 1995 Visiting Scientist, Department of Plant and Soil, Mississippi State University, USA.

Jul. 1991-Jul. 1994 Research Assistant and Assistant Professor, Shijiazhuang Institute of Agricultural Modernization Chinese Academy of Sciences.

C. HONORS AND ACADEMIC AWARDS

2013，Physiological and Molecular Mechanisms of Heavy Metal Tolerance in Plants, The third class award for natural science achievements, Hebei Provincial Government.

2013, The excellent research group award of the Institute

2012, National excellent researcher award of science and technology, China Association for Science and Technology.

2010, Excellent researcher award of science and technology of Hebei Province, Hebei Association for Science and Technology.

D、MAJOR RESEARCH INTERESTS，SELECTED RESEARCH PROJECTS, research background, major research achievements, current research and future directions

(A). MAJOR RESEARCH INTERESTS

In the past five years, the group is mainly focus on salt affected soils, saline water and salt tolerant plants to investigate the physiological and molecular mechanisms of plant adapted to saline soils, innovate the integrate management of saline soils and saline water resources, and demonstrate the technologies and models

of efficient agricultural utilization of saline resources for the sustainable development of agriculture in salt affected land.

(B). Selected research projects 2009-2013

Research and demostration on integrated technologies for safely directive irrigation with saline water to salt tolerant plants. National Key Technologies R&D Program. 2009-2011.

Research and demonstration on integrate technologies and models for efficient agricultural utilization of salt-affected land in Huang-Huai-Hai Plain. Special S&T program for public welfare industry (agriculture). 2009-2013.

Molecular design of stress tolerant wheat and innovation of germplasm. National Basic Research Program of China (973 program). 2009-2013.

Research and demonstration on integrate technologies for increasing crop yield in salt affected area around Bohai Sea. Knowledge innovation program of the Chinese Academy of Sciences. 2010-2012.

Research and demonstration on integrate agronomic technologies for reforestration in coastal saline regions, 2011-2013

Mechanisms and technologies for improving saline soils by freezing saline water irrigation in winter around Bohai Sea. Knowledge innovation program of the Chinese Academy of Sciences. 2009-2011.

The dynamics of soil salt and water in coastal saline soils under the infiltration of melting saline ice water, National Natural Science Foundation,2012-2015.

（C）research background

Salinization of soils and groundwater is a serious land-degradation problem in arid and semi-arid areas, and is increasing steadily in many parts of the world due to poor irrigation and drainage practices, which causing various problems for crop productivity. It was estimated that over 800 million hectares of land throughout the

world are salt-affected which is over 6% of the world's total land area. Of the current 230 million *ha* of irrigated land, 45 million *ha* are salt-affected (19.5%). Of the 1,500 million *ha* of land farmed by dryland agriculture, 32 million *ha* (2.1%) are affected by secondary salinization to varying degrees. The total area of salt affected soils in China is about 33 million *ha* which is important land resources for crop production. Excess salts in the soil adversely affect plant growth and development by decreasing the osmotic potential of soil solution creating a water stress in plants, ion toxicity, and nutrient imbalance. The consequence of all these can ultimately lead to decrease of crop yield even to plant death.

Mankind has been dealing with the soil salt problems for a long time. To reclaim the saline soils, the most effective and conventional methods are drainage and leaching methods. However because shortage of freshwater resources, it is foreseeable that these methods of reclamation will become limited, and the cost of leaching and drainage system is beyond what a community can afford. Therefore, salt affected soils need immediate attention for efficient, low cost and environmentally acceptable management to improve productivity of crop species that can be grown on such soils.

Focusing on salt affected soils, saline water and salt tolerant plants, the aims of our group are to invesigate the physiological and molecular mechanisms of plant adapted to saline soils, to innovate the integrate management of saline soils and saline water resources, and demonstrate the technologies and models of efficient agricultural utilization of saline resources for the sustainable development of agriculture in salt affected land.

（D）Major research achievements

1. Mechanisms of stress tolerance in plants

（1）Differential Salt Tolerance in Seedlings Derived from Dimorphic Seeds of *Atriplex centralasiatica*: from Physiology to Molecular Analysis

Seed dimorphism provides plants with alternative strategies for survival in unfavorable environments. The two seed morphs show different degrees of salt

tolerance. However, the molecular details of differential salt tolerance in seedlings derived from different seed morphs are not fully understood. Here, we investigated the physiological responses and differential gene expression caused by salinity exposure in plants grown from the two seed morphs of *Atriplex centralasiatica*. Yellow seeds (YS) showed a greater salt tolerance in the seedlings than did the seedlings derived from brown seeds (BS). Salt treatment induced nitric oxide (NO) synthesis in roots, and seedlings derived from YS produced greater amounts of NO than did those from BS. Analyses of NO scavenging during salt stress revealed that NO contributed to the differential salt tolerance in seedlings derived from the two seed morphs by modulating antioxidative enzyme activity, hydrogen peroxide accumulation and the ion equilibrium. We also applied transcriptomics and succedent microarray analysis to evaluate the differential gene expression during salt treatment. These genes encoded proteins related to osmotic and ionic homeostasis, redox equilibrium and signal transduction. A select group of genes including GH3.3, CAT1/2, TIP1, SIHP1 and EXP1 were further confirmed with RT-PCR analysis. These results revealed that the enhanced salt tolerance of seedlings from YS appeared to be governed by a superior ability to achieve ionic homeostasis and redox equilibrium, a rapid response to salt stress, and ultimately better growth potential. NO serves as a vital regulator in these processes.

(2) Nitric oxide is associated with long-term Zn tolerance in *Solanum nigrum*

Nitric oxide (NO) has been identified as a signal molecule that interplays with reactive oxygen species in response to heavy metal stresses. Roles of NO in regulating cadmium (Cd) toxicity and irondeficiency have been proposed; however, the function of NO in zinc (Zn) tolerance in plants remains unclear. Here we investigated NO accumulation and its role in plants Zn tolerance. Zn-induced NO production promoted an increase in ROS accumulation in *Solanum nigrum* roots by modulating the expression and activity of antioxidative enzymes. Subsequently, programmed cell death (PCD) was observed in primary root tips. Inhibiting NO accumulation prevented the increase of superoxide radical and hydrogen peroxide as well as the subsequent cell death in the root tips, supporting the role of NO in Zn-induced PCD in

the root tips. Zn-induced NO production affected the length of primary roots, the number of lateral roots and root hair growth and thereby modulated root system architecture and activity. Investigation of metal contents in Zn-treated roots suggests that NO is required for metal (especially Fe) uptake and homeostasis in plants exposed to excess Zn. Taken together, our results indicate that NO production and the subsequent PCD in root tips exposed to excess Zn are favorable for *S. nigrum* seedlings response to long-term Zn toxicity by modulating root system architecture and subsequent adaptation to Zn stress.

(3) **Comparative physiological and proteomic response to abrupt low temperature stress between two winter wheat cultivars differing in low temperature tolerance**

Abrupt temperature reduction in winter wheat at either autumn seedling stage prior to vernalisation or early spring crown stage can cause severe crop damage and reduce production. Many studies have reported the physiological and molecular mechanisms underlying cold acclimation in winter wheat by comparing it with spring wheat. However, processes associated with abrupt temperature reduction in autumn seedling stage prior to vernalisation in winter wheat are less understood. In this study, physiological and molecular responses of winter wheat seedlings to abrupt low temperature (LT) stress were characterised in the relatively LT-tolerant winter wheat cultivar Shixin 828 by comparing it with the relatively LT-sensitive cultivar Shiluan 02-1 using a combination of physiological, proteomics and biochemical approaches. Shixin 828 was tolerant to abrupt LT stress, while Shiluan 02- 1 exhibited high levels of reactive oxygen species (ROS) and leaf cell death. Significant increases in relative abundance of antioxidant-related proteins were found in Shixin 828 leaves, which correlate with observed higher antioxidant enzyme activity in Shixin 828 compared to Shiluan 02-1. Proteomics analysis also indicated that carbohydrate metabolism-related proteins were more abundant in Shiluan 02-1, correlating with observed accumulation of soluble sugars in Shiluan 02-1 leaves. Amino acid analysis revealed a strong response to LT stress in wheat leaves. A negative effect of exogenous sucrose on LT

tolerance was also found. This study indicates that high ROS scavenging capacity and high abundance of photosynthesis-related proteins might play a role in winter wheat response to abrupt LT stress. In contrast, excess accumulation of soluble sugars might be disadvantageous for LT tolerance in the wheat cultivar Shiluan 02-1.

2. Improving saline soils by freezing saline water irrigation in winter

In very strongly saline soil of coastal plain along Bohai Sea, the salt content of soil is usually higher than 1.0% and the groundwater table is around 1m with high salinity, where almost no plants can grow except for some halophytes. The freshwater deficiency restricts the reclaim of such soils. To improve this saline soil, we invented a new method *i.e.* freezing saline water irrigation in winter. In the monsoon regions with cold winter, saline groundwater is used for irrigation in winter, which will be frozen to ice. The saline ice melts gradually in spring and produced more than 50% slightly saline water and fresh water from 15g/L source water. Since meltwater at initial thawing stages contains more salts, infiltration of late-melted freshwater would wash out the deposited salts and create a desalinized soil surface layer. The results of soil culumns experiments showed that in the top soil layers, water content was higher under salt-free ice treatment than under saline ice treatments. In the deeper soil layers, however, the saline ice treatments showed higher water content than the salt-free ice treatment. While infiltration of meltwater reduced the salt content of the surface layer of all the treatments, the desalting depths of the saline ice treatments were greater than the desalting depth of the salt-free ice treatment. The field experiments indicated that after irrigation with the volume of 135-180 mm saline water (11-15g/L) in early to mid January (the mean temperature <-3℃), the water frozen well on saline soil surface. After the infiltration of melted saline ice water in late February, the soil surface in 20cm depth desalinized greatly in which the soil salt content was less than 0.4%, while that of no irrigated land was more than 1.0%. To prevent the evaporation and salt accumulation on soil surface in spring season, soil salinity was further reduced by plastic film mulching. At sowing season, late April, the surface soil salt content was about 0.3%. The emergency rate of cotton was higher than 90%, while there was almost no emergency in control. The reason why the infiltration of melted

saline ice water increased soil desalinization were the replacement of Na^+ in soils by divalent ions (*e.g.*, Ca^{2+}) in earlier melted saline water prevents clay dispersion and preserves soil structure and permeability, the later melted slightly or fresh water wash out the salts. In addition the coverage of ice on soil surface increased the soil temperature which declined the salt accumulation by frozen. Following rainfall in summer kept low soil surface salinity and crop growth. Based on above results, we designed an integrate management of saline soil by freezing saline water irrigation in winter and some models were also constructed. The application of this method had achieved good yield in cotton, sunflower, sorghum etc. in strongly coastal saline land.

3、Integrate management of salt-affected soils

Based previous achievements, the integrate management of salt-affected soils including salt tolerant wheat and maize, saline water irrigation, reclamation of saline soils, halophytes utilization etc. was constructed and 4 demonstrations sites in low land plain around Bohai Sea were established. In Haixing county, the strongly saline land, where we are developing and demonstrating the cash crop halophytes and freezing saline water irrigation. Two new varieties of wolfberry and one new variety of Tamarix Chenisis were selected and a 30 ha of halophytes garden was established. The freezing saline water irrigation in winter was applied to cotton and other crops production. In Nanpi county, the desalinized land, where long term experiments on fertilizers, crop systems and saline water irrigation *etc*. were established. The technologies for increasing crop yield were applied. In Nandagang of Bohai New Zone, the slightly and moderate saline land with rain feed agriculture, where we are developing and demonstrating the technologies on how to increase rain water and saline water use efficiency and build high efficient crop systems. In Caofeidian New Developmental Zone, the strongly saline land, where we are developing and demonstrating the technologies on reforestration in saline lands.

The development and demonstration on the technologies for efficient agricultural utilization of saline land has been inducing the attention from farmers, policy makers,

businessmen and scientists *etc*. The president of CAS, Prof. Bai Chunli, the vice presidents, Profs. Li Jiayang, Zhang Yaping and Shi Erwei and the Governor of Hebei Province, Mr. Zhang Qiwei, the vice Governors, Mr. Shen Xiaoping, Xu Ning and Zhao Yong visited the demonstraion sites. A new national scientific and technological R&D program, Increasing crop yield in low and middle yield regions around Bohai sea—Bohai sea Granary, were funded. The target of the program was increasing 5 billion Kg cereal in 2020 which will strongly support the land and food security.

（E）Current research and future directions

1. Current research

Currently, our group is mainly conducting the research on saline soil reclamation and increasing crop prodctivity in salt-affected soils. The major projects are as follows:

(1) National Key Technologies R&D Program: Research and demonstration on the technologies for high efficient utilization of Multi-water resouces.2013-2017.

(2) National Key Technologies R&D Program: Research and demonstration on the technologies for increasing crop productivity in salt-affected area of Hebei province around Bohai sea. 2013-2017.

(3) National Key Technologies R&D Program: Selection of salt tolerant plants for vegetation construction and optimizing the species structure in coastal saline soils. 2013-2016

(4) National Key Technologies R&D Program: Research and demonstration on the technologies for improving salt-affected soils in coastal regions.2012-2015.

(5) China-Slovakia joint research project: Mechanism and technologies for improving plant stress tolerance. 2013-2014.

2. Future directions

In the future 5 years or more, facing on the national and regional demands of food security and environmental improvement, our group will being still focus on salt

affected soils, saline water and salt tolerant plants, and start the following works:

1) mechanisms of plant stress tolerance, especially how the plants adapt to surface desalinized soils.

2) modelling the dynamics of soil salt, water and temperature under the infiltration of melting saline ice water, which will be aid to reveal the mechanism of desalinization and support the extensive application of freezing saline water irrigation in winter.

3) halophyte utilization and forestation in strongly saline soil, considering the C sequestration.

4) technologies of increasing crop yield in salt affected land for food security.

F、funding and laboratory personnel

1、Fundings

During the past 5 years, we got the supports from Ministry of Science and Technology, Ministry of Agriculture, National Natural Science Foundation and Chinese Academy of Sciences. A total 15 million RMB fundings was granded to our group. The projects conducted are as follows:

(1) Research and demostration on integrated technologies for safely directive irrigation with saline water to salt tolerant plants. National Key Technologies R&D Program. 2009-2011.

(2) Molecular design of stress tolerant wheat and innovation of germplasm. National Basic Research Program of China (973 program). 2009-2013.

(3) Research and demonstration on integrated technologies and models for efficient agricultural utilization of salt-affected land in Huang-Huai-Hai Plain. Special S&T program for public welfare industry (agriculture). 2009-2013.

(4) Research and demonstration on integrated technologies for increasing crop yield in salt affected area around Bohai Sea. Knowledge innovation program of the Chinese Academy of Sciences.

(5) Mechanisms and technologies for improving saline soils by freezing saline water irrigation in winter around Bohai Sea. Knowledge innovation program of the Chinese Academy of Sciences. 2009-2011.

(6) Research and demonstration on integrate agronomic technologies for reforestration in coastal saline regions. Knowledge innovation program of the Chinese Academy of Sciences. 2011-2013.

(6) The dynamics of soil salt and water in coastal saline soils under the infiltration of melting saline ice water. National Natural Science Foundation, 2012-2015.

2、Laboratory personnel

During the past 5 years, a total 8 permanent staffs and 7 graduate students joined in our group. In addition, we hired 8 technitians to assist us to do the lab and field works.

Permanent staff

Dr.Xiaojing Liu, Professor, Agronomy

Dr. Mao Renzhao, Professor, Soil science

Dr. Ju Zhaoqiang, Assistant Professor, Soil Science

Dr. Xie Zhixia, Associate Professor, Plant Physiology

Dr. Yang Lilin, Senior Engineer, Plant Nutrition

Dr. Xu Jin, Associate Professor, Molecular Biology

Mrs. Zhang Xiumei, Senior Engineer, Forestry

Dr. Li Xiangjun, Associate Professor, 2009-2011

Graduate Students

Chen Lina, 2009-2012(PhD)

Guo Kai, 2010-2014(PhD)

Yu Qiong, 2010-(Master，PhD)

Yan Sufang, 2009-2012(Master)

Li Yulong, 2010-2013(Master)

Yang Ting, 2011-2014(Master)

Cui Baoyu, 2011-2013(Master)

Guo Yuan,2012-(Master)

Technician

Mr. Sun Jialing

Mr. Yuan Jiping

Ms. Gong Guiying

Mr. Guo Jinyu

Ms. Feng Xinyan

Mr. Wang Lizhong

Mr. Sun Jingying

Mr. Wu Jinxiang

G、 SELECTED PUBLICATIONS, PATENTS GRANTED， VARIETIES OBTAINED, major invited international conference talks

（A）Publications

During the past 5 years, we published 27 papers. 13 of that were published in international journals, such as in Plant Physiology， New Phytologist, plata etc.

1. Zhaoqiang Ju, Xiaona Liu, Xiaojing Liu. **2013.** An improved calibration determining soil bulk density with time domain reflectometry. **Communications in soil science and plant analysis.** 44 (6): 1072-1079.
2. Jin Xu, Yulong Li, Jianhang Sun, Liguo Du, Yuan Zhang, Qiong Yu, **Xiaojing Liu**. **2013.** Comparative physiological and proteomic response to abrupt low temperature stress between two winter wheat cultivars differing in low temperature tolerance. **Plant Biology. 15: 292-303**.
3. Jin Xu, Jianhang Sun, Liguo Du, Xiaojing Liu. Comparative transcriptome analysis of cadmium responses in Solanum nigrum and Solanum torvum. **New Phytologist.** 2012, 196: 110-124.
4. Jin Xu, Yiyong Zhu, Qing Ge, Yulong Li, Jianhang Sun, Yuan Zhang, Xiaojing Liu. Comparative physiological responses of *Solanum nigru*m and *Solanum torvum* to cadmium stress. **New Phytologist.** 2012, 196: 124-138.
5. **Jin Xu**, Wenying Wang, Jianhang Sun, Yuan Zhang, Qing Ge, Liguo Du, Hengxia Yin, **Xiaojing Liu***. 2011. Involvement of auxin and nitric oxide in plant Cd-stress responses. ***Plant and soil***. 10.1007/s11104-011-0800-4
6. Lina Chen, Hengxia Yin, **Jin Xu, Xiaojing Liu. 2011.** Enhanced antioxidative responses of a salt-resistant wheat cultivar facilitate its adaptation to salt stress. ***African Journal of Biotechnology***. http://www.academicjournals.org/AJB
7. Jin Xu, Hengxia Yin, Lilin Yang, Zhixia Xie and **Xiaojing Liu**. 2011. Differential salt tolerance in seedlings derived from dimorphic seeds of *Atriplex centralasiatica*: from physiology to molecular analysis. **Planta,** 5,859-871.
8. Li, W., **Liu, X**., Hanada, A. and Khan, M.A. 2011. Effect of cold stratification, scarification and hormones on germination of dimorphic seeds of *Atriplex centralasiatica* under saline conditions. **Seed Sci. & Technol.**, 39, 82-92
9. Jin Xu, Hengxia Yin, Xiaojing Liu, Xia Li. Salt affects plant Cd-stress responses by modulating growth and Cd accumulation. **Planta.** 2010, DOI 10.1007/s00425-009-1070-8
10. Weiqiang Li, M. Ajmal Khan, Xiumei Zhang, and **Xiaojing Liu.** Rooting and shoot growth of stem cuttings of saltcedar (*Tamarix Chinensis* Lour) under salt stress. **Pakistan Journal of Botany.** 2010, 42(6): 4133-4142
11. Jin Xu, Hengxia Yin, Yulong Li, **Xiaojing Liu**. Nitric Oxide Is Associated with Long-Term Zinc Tolerance in *Solanum nigrum*. **Plant Physiology.** 2010. 154: 1319-1334
12. Lilin Yang, Fusuo Zhangb, Qiang Gaoc, Renzhao Mao, **Xiaojing Liu**. 2010. Impact of land-use types on soil nitrogen net mineralization in the sandstorm and water source area of Beijing, China. **Catena** 82: 15–22.

13. Jin Xu, Wenying Wang, Hengxia Yin, **Xiaojing Liu**, Hong Sun, Qin Mi. Exogenous nitric oxide improves antioxidative capacity and reduces auxin degradation in roots of *Medicago truncatula* seedlings under cadmium stress. **Plant and soil** 2010,326:321-330
14. Jin Xu, Hengxia Yin, Wenying Wang, Qin Mi, **Xiaojing Liu**. 2009. Effects of sodium nitroprusside on callus induction and shoots regeneration in micropropagated *Dioscorea opposita*. **Plant Growth Regulation**. 59:279–285.
15. Guo Kai, Liu Xiaojing. The Primary Research on Water Quality and Quantity the Variation of Melted During Saline Ice Melting. **Journal of Irrigation and Drainage**. 2013,32(1):56-60
16. Feng Xiaohui, Zhang Xiumei, Liu Xiaojing, Cheng Ruimei,Sun Huanrong. Growth dynamics of Tamarix chinensis plantations in heavy-saline coastal lands and related ecological effects. **Chinese Journal of Eco-Agriculture,** 2013, 21(10):1233-1240.
17. Mu Jing, Liu Xiaojing, Xu Jin, Mao Renzhao, Wei Wei, Yang Lilin. Effects of nitrogen on sweet sorghum seed germination, seedling growth and physiological traits under NaCl stress. **Chinese Journal of Eco-Agriculture,** 2012，20（10）： 1303-1309.
18. Wang Wencheng et al. Effect of saline ice irrigation on the soil salt distribution and vegetation restoration in the marine reclamation land. **Chinese Journal of Eco-Agriculture,** 2012，20（10）： 1409-1411.
19. Zhang Xiumei, Guo Kai, Xie Zhixia, Feng Xiaohui, Liu Xiaojing. Effect of frozen saline water irrigation in winter on soil salt and water dynamics, emergency and yield of cotton in coastal soils. **Chinese Journal of Eco-Agriculture,** 2012, 20(10):1310-1314.
20. Yan Sufang et al. Effect of exogenous sucrose application on wheat seedling salt tolerance. **Chinese Journal of Eco-Agriculture,** 2012, 20(2):225-230.
21. Li Zhensheng, Ouyang Zhu, Liu Xiaojing, Hu Chunsheng. Scientific Basis for Constructing the "Bohai Sea Granary" --- Demands, Potential and Approches. Bulletin of the Chinese Academy of Sciences, 2011,26（4）： 371-374.
22. Guo Kai,Chen Lina, Liu Xiaojing. Water and salt distribution in coastal saline soil after infiltration of melt-water of saline water ice with different sodium adsorption ratio. Chinese Journal of Eco-Agriculture. 2011, 19(3):506-510.
23. Guo Kai, Zhang Xiu-mei, Li Xiang-jun, Yang Li-lin, Liu Xiao-jing. 2010b. Water and salt transport on Soda alkline soil after infiltration with melting saline ice water of different SAR. Journal of Soil and Water Conservation 24（4）： 94-98.(in Chinese)
24. Liu Xiaojing, Li Xiangjun, Chen Lina,Sui Peng. 2010. Study on the adaptive farming system in saline soils: A case study in saline area of strand plain in Hebei Province. Chinese Journal of Eco-Agriculture 18（4）： 911-913. (in Chinese)
25. Guo Kai, Zhang Xiumei, Li Xiangjun, Liu Xiaojing. 2010a. Effect of Freezing Saline Water Irrigation in Winter on the Reclamation of Coastal Saline Soil. Resources Science 32（3）： 431-435. (in Chinese)
26. Chen Cheng-sheng, Xie Zhi-Xia, Liu Xiao-Jing.2009b. Dynamic transformation of the substances of osmotic adjustmant in winter wheat under iso-osmotic salt and drought stress. Bulletin of Botanical Research 29（6）：708-713. (in Chinese)
27. Chen Cheng-sheng, Xie Zhi-Xia, Liu Xiao-Jing. 2009a. Interactive effects of drought and salt stresses on winter wheat seedlings growth and physiological characterastics of stress-resistance. Chinese Journal of Applied Ecology 20（4）：811-816

（B）PATENTS GRANTED

During the past 5 years, 8 invention patents were granted to our group.

1. Liu Xiaojing, Tian Kuixiang, Li Weiqiang, Wang Rong, Gao Fucun, Zhang Xinzhou. A method for reclaiming saline soils by natural freezing saline water. ZL200510012450

2. A method to grow cotton in coastal saine soil. Liu Xiaojing, Zhang Xiumei, Xie Zhixia, Guo Kai, Chen Lina, Bai Jinli.

3. A method to grow sunflower in coastal saine soil. Liu Xiaojing, Zhang Xiumei, Guo Kai, Xie Zhixia, Chen Lina, Ju Zhaoqiang.

4. A method to grow sugarbeet in coastal saine soil. Liu Xiaojing, Zhang Xiumei, Chen Lina, Xie Zhixia, Ju Zhaoqiang, Guo Kai.

5. A method to grow *Tamarix Chensis* with stalk directly in coastal saine soil. Zhang Xiumei, Liu Xiaojing et al.

6. The sweet sorghum planting method in the costal heavy saline soil, Xiaojing Liu, Xiumei Zhang

7. A fast decompose method for Returned summer corn stover Lilin Yang ,Xiaojing Liu

8. Fertilization technique for wheat maize rotation grown in salt- affected soils without irrigation Lilin Yang, Xiaojing Liu

（C）VARIETIES OBTAINED

1. New *Lycium barbarum* variety “Yanqi”was approved by Hebei Approval Committee of Forestry Variety in 2009. Xiumei Zhang, Xiaojing Liu, Jifeng Yan, Zhixia Xie, Zhenjiang Yang, Xiangjun Li, Chunqin Liu, Aijun Wang, Lilin Yang, Jinxiang Yuan, Yantao Liu, Lihua Liu.

2. New *Lycium barbarum* variety “Haiqi” was approved by Hebei Approval Committee of Forestry Variety in 2009. Xiumei Zhang, Xiaojing Liu, Jifeng Yan, Lilin Yang, Lianzhou Wang,Xiangjun Li,Zhenjiang Yang, Aijun Wang, Zhixia Xie,Hongxia Zhang, Hongguo Meng, Kaisen Li.

3. New *Tamarix chinensis* Lour. variety “Haicheng No. 1” was approved by Hebei Approval Committee of Forestry Variety in 2013. Liu Xiaojing, Zhang Xiumei.

(D) major invited international conference talks

1. Reclamation of saline soils by freezing saline water irrigation in winter. International workshop on Hydropedology and sustainable use of natural resource, June 29-30, 2013, Beijing.

2. Approaches on freezing saline water irrigation. The 12th Conference of Soil Science Society of China.August 20-23,2012. Chengdu, Sichuan Province.

3. A primary study on adaptive mechanism of cotton roots to saline soil. 20th anniversary of Japan Society for Root Research. November 5-7, 2011. Tokyo, Japan.

G、editorial duties

H、conference organization

Deputy director，the 12th specialty committee of salt-affected soils, Soil Science Society of China.