全国中文核心期刊
中国科技核心期刊
中国农业核心期刊
RCCSE中国核心学术期刊
中国科学引文数据库（CSCD）期刊
CAB International 收录期刊
美国《生物学文摘》收录期刊
美国《化学文摘》（CA）收录期刊

«上一篇 下一篇
(DArticle.aspx?type=view&id=201106002)

PDF下载 (pdfdow.aspx?Sid=201106001)
+分享 (http://www.jiathis.com/share?uid=1541069)


微信公众号：大豆科学

[1]王敏娟,侯文胜,王庆钰,等.过表达GmNHX1基因提高大豆根系的耐盐性[J].大豆科学,2011,30(06):889-894.
[doi:10.11861/j.issn.1000-9841.2011.06.0889]
WANG Min-juan,HOU Wen-sheng,WANG Qing-yu,et al.Enhancing Salt Tolerance of Soybean Roots by Overexpression of GmNHX1[J].Soybean Science,2011,30(06):889-894.[doi:10.11861/j.issn.1000-9841.2011.06.0889]
点击复制

过表达GmNHX1基因提高大豆根系的耐盐性

《大豆科学》 [ISSN:1000-9841 /CN:23-1227/S] 卷： 第30卷 期数： 2011年06期 页码： 889-894 栏目：
出版日期： 2011-12-25

Title: Enhancing Salt Tolerance of Soybean Roots by Overexpression of GmNHX1

文章编号： 1000-9841（2011）06-0889-06

作者： 王敏娟[1] (KeySearch.aspx?type=Name&Sel=王敏娟)[2] (KeySearch.aspx?type=Name&Sel=2</sup>) (KeySearch.aspx?type=Name&Sel=2</sup>)； 侯文胜[1] (KeySearch.aspx?type=Name&Sel=侯文胜)； 王庆钰[2] (KeySearch.aspx?type=Name&Sel=王庆钰)； 林汉明[2] (KeySearch.aspx?type=Name&Sel=林汉明)[3] (KeySearch.aspx?type=Name&Sel=3</sup>) (KeySearch.aspx?type=Name&Sel=3</sup>)； 韩天富[1] (KeySearch.aspx?type=Name&Sel=韩天富)
1.中国农业科学院 作物科学研究所，国家农作物基因资源与基因改良重大科学工程，北京 100081；
2.吉林大学 植物科学学院，吉林 长春 130062； 3.香港中文大学 生命科学院，中国 香港

Author(s): WANG Min-juan[1] (KeySearch.aspx?type=Name&Sel=WANG Min-juan)[2] (KeySearch.aspx?type=Name&Sel=2</sup>) (KeySearch.aspx?type=Name&Sel=2</sup>)； HOU Wen-sheng[1] (KeySearch.aspx?type=Name&Sel=HOU Wen-sheng)； WANG Qing-yu[2] (KeySearch.aspx?type=Name&Sel=WANG Qing-yu)； LAM Hon-ming[2] (KeySearch.aspx?type=Name&Sel=LAM Hon-ming)[3] (KeySearch.aspx?type=Name&Sel=3</sup>) (KeySearch.aspx?type=Name&Sel=3</sup>)； HAN Tian-fu[1] (KeySearch.aspx?type=Name&Sel=HAN Tian-fu)
1.The National Key Facility for Crop Gene Resources and Genetic Improvement(NFCRI),Institute of Crop Science,Chinese Academy of Agricultural Sciences,Beijing 100081,China;?
2.College of Plant Science,Jilin University,Changchun 130062,Jilin,China;?
3.School of Life Sciences,Chinese University of Hong Kong,Hong Kong SAR,China

关键词： 大豆 (KeySearch.aspx?type=KeyWord&Sel=大豆)； 发根农杆菌 (KeySearch.aspx?type=KeyWord&Sel=发根农杆菌)； GmNHX1 (KeySearch.aspx?type=KeyWord&Sel=GmNHX1)； 根系 (KeySearch.aspx?type=KeyWord&Sel=根系)； 耐盐性 (KeySearch.aspx?type=KeyWord&Sel=耐盐性)

Keywords: Soybean (KeySearch.aspx?type=KeyWord&Sel=Soybean)； Agrobacterium rhizogenes (KeySearch.aspx?type=KeyWord&Sel=Agrobacterium rhizogenes)； GmNHX1 (KeySearch.aspx?type=KeyWord&Sel=GmNHX1) (KeySearch.aspx?type=KeyWord&Sel=GmNHX1)； Roots (KeySearch.aspx?type=KeyWord&Sel=Roots)； Salt tolerance (KeySearch.aspx?type=KeyWord&Sel=Salt tolerance)

分类号： S565.1

DOI: 10.11861/j.issn.1000-9841.2011.06.0889 (http://dx.doi.org/10.11861/j.issn.1000-9841.2011.06.0889)

文献标志码： A

摘要： Na+/H+反向转运蛋白可调控细胞质pH值、钠离子浓度和细胞体积，从而减轻盐胁迫对植物的伤害。利用发根农杆菌（Agrobacterium rhizogenes）介导法，向大豆根系导入由CaMV35S启动子调控的Na+/H+反向转运蛋白编码基因GmNHX1的cDNA序列，通过该基因的过量表达，提高大豆的耐盐性。通过潮霉素筛选、GUS染色及RT-PCR检测，确认获得了转GmNHX1基因的大豆发状根。对转基因发状根耐盐性分析表明：在100、150和200 mmol·L^{-1}的NaCl胁迫下，置于MS固体培养基中的转基因离体发状根的长度和重量增加值均显著大于对照。带有转基因发状根的子叶及复合体植株在盐胁迫条件下也具有较强的生存能力。试验证明，过表达GmNHX1基因能够显著提高转基因发状根的耐盐性，该结果为利用GmNHX1基因进行大豆耐盐性的改良提供了依据。

Abstract: Na+/H+antiporter is responsible for the regulation of cytoplasmic pH,sodium concentration and cell volume for plants to cope with salt stress.To enhance the salt tolerance of soybean,the GmNHX1 cDNA that encodes a soybean Na+/H+ antiporter protein was driven by the Cauliflower Mosaic Virus 35S promoter and overexpressed in soybean roots via Agrobacterium rhizogenes mediated transformation.Hpt screening,GUS and RT-PCR analysis all confirmed that GmNHX1 was successfully integrated into the genome of soybean hairy roots.Salt tolerance analysis showed that the growth in length and weight of the transgenic hairy roots on MS agar medium were significantly better than the non-transgenic control,when supplemented with 100,150 and 200 mmol·L^{-1} NaCl.Both the cotyledons and composite plants with transgenic hairy roots survived better than the non-transgenic control when subjected to salinity stress.These results support the possibility of using GmNHX1 to improve salt tolerance in soybean.

参考文献/References:

[1]Lee G J,Boerma H R,Villagarcia M R,et al.A major QTL conditioning salt tolerance in S-100 soybean and descendent cultivars[J].Theoretical and Applied Genetics,2004,109(8):1610-1619.
[2]Li F W Y,Wong F L,Tsai S N,et al.Tonoplast-located GmCLC1?and GmNHX1?from soybean enhance NaCl tolerance in transgenic bright yellow(BY)-2 cells[J].Plant,Cell and Environment,2006,29(6):1122-1137.
[3]Li F W Y,Shao G， Lam H M.Ectopic expression of GmPAP3?alleviates oxidative damage caused by salinity and

osmotic stresses[J].New Phytologist,2008,178(1):80-91.
[4]Zhou Q Y,Tian A G,Zou H F,et al.Soybean WRKY-type transcription factor genes,GmWRKY13,GmWRKY21?and GmWRKY54,confer differential tolerance to abiotic stresses in transgenic Arabidopsis?plants[J].Plant Biotechnology Journal,2008,6(5):486-503.
[5]Di R,Purcell V,Collins G B,et al.Production of transgenic soybean lines expressing the bean pod mottle virus coat protein precursor gene[J].Plant Cell Reports,1996,15(10):746-750.
[6]Hinchee M A W,Connor-Ward D V,Newell C A,et al.Production of transgenic soybean plants using Agrobacterium-mediated DNA transfer[J].Nature Biotechnology,1988,6(8):915-922.
[7]Stewart C N J,Adang M J,All J N,et al.Genetic transformation,recovery and characterization of fertile soybean transgenic for a synthetic Bacillus thuringensis cryIAcgene[J].Plant Physiology,1996,112(1):121-129.
[8]于洋,侯文胜,韩天富.农杆菌介导大豆遗传转化技术的研究进展[J].大豆科学,2010,29(4):696-701.(Yu Y,Hou W S,Han T F.Approaches to Agrobacterium?tumefaciens-mediated transformation in soybean[J].Soybean Science,2010,29(4):696-701.)
[9]Yan B,Srinivasa Reddy M S,Collins G B,et al.Agrobacterium tumefaciens-mediated transformation of soybean [Glycine max(L.)Merrill.]using immature zygotic cotyledon explants[J].Plant Cell Reports,2000,19(11):1090-1097.
[10]Cao D,Hou W,Song S,et al.Assessment of conditions affecting Agrobacterium rhizogenes-mediated transformation of soybean[J].Plant Cell,Tissue and Organ Culture,2009,96(1):45-52.
[11]Wyn Jones R G.Salt tolerance[M]//Johnson C B.Physiological processes limiting plant productivity,Butterworths,London-Boston,1981:271-292.
[12]Apse M P,Aharon G S,Snedden W A,et al.Salt tolerance conferred by overexpression of a vacuolar Na+/H+ antiport in Arabidopsis[J].Science,1999,285(5431):1256-1258.
[13]Fukuda A,Yazaki Y,Ishikawa T,et al.Na+/H+antiporter in tonoplast vesicles from rice roots[J].Plant Cell Physiology,1998,39(2):196-201.
[14]Waditee R,Hibino T,Nakamura T,et al.Overexpression of a Na^+/H^+ antiporter confers salt tolerance on a freshwater cyanobacterium,making it capable of growth in sea water[J].Proceedings of the National Academy of Sciences of the United States of America,2002,99(6):4109-4114.
[15]Gao X,Ren Z,Zhao Y,et al.Overexpression of SOD2 increases salt tolerance of Arabidopsis[J].Plant Physiology,2003,133(4):1873-1881.
[16]Shi H,Lee B H,Wu S J,et al.Overexpression of a plasma membrane Na+/H+antiporter gene improves salt tolerance in Arabidopsis thaliana[J].Nature Biotechnology,2002,21(1):81-85.
[17]Zhang H X,Hodson J N,Williams J P,et al.Engineering salt-tolerant Brassica?plants:Characterization of yield and seed oil quality in transgenic plants with increased vacuolar sodium accumulation[J].Proceedings of the National Academy of Sciences of the United States of America,2001,98(22):12832-12836.
[18]Zhang H X,Blumwald E.Transgenic salt-tolerant tomato plants accumulate salt in foliage but not in fruit [J].Nature Biotechnology,2001,19(8):765-768.
[19]Ohta M,Hayashi Y,Nakashima A,et al.Introduction of a Na+/H+ antiporter gene from Atriplex gmelini?confers salt tolerance to rice[J].FEBS Letters,2002,532(3):279-282.
[20]Fukuda A,Nakamura A,Tagiri A,et al.Function,intracellular localization and the importance in salt tolerance of a vacuolar Na^+/H^+ antiporter from rice[J].Plant and Cell Physiology,2004,45(2):146-159.
[21]Xue Z Y,Zhi D Y,Xue G P,et al.Enhanced salt tolerance of transgenic wheat(Triticum aestivum?L.)expressing a vacuolar Na^+/H^+ antiporter gene with improved grain yields in saline soils in the field and a reduced level of leaf Na+[J].Plant Science,2004,167(4):849-859.
[22]Vickers C E,Schenk P M,Li D,et al.pGFPGUS-Plus,a new binary vector for gene expression studies and optimizing transformation systems in plants[J].Biotechnology Letters,2007,29(11):1793-1796.
[23]Jefferson R A,Kavanagh T A,Bevan M W.GUS?fusions:beta-glucuronidase as a sensitive and versatile gene fusion marker in higher plants[J].EMBO Journal,1987,6(13):3901-3907.
[24]Sieburth L E,Meyerowitz E M.Molecular dissection of the AGAMOUS control region shows that cis elements for spatial regulation are located intragenically[J].Plant Cell,1997,9(3):355-365.
[25]周宜君,冯金朝,马文文,等.植物抗逆分子机制研究进展[J].中央民族大学学报（自然科学版）.2006,15(2):169-176.(Zhou Y J,Feng J C,Ma W W,et al.Progress of molecular mechanism of stress resistance in plants[J].Journal of the Central University for Nationalities(Natural Science Edition)2006,15(2):169-176.)
[26]杨晓慧,蒋卫杰,魏珉,等.提高植物抗盐能力的技术措施综述[J].中国农学通报,2006,22(1):88-91.(Yang X H,Jiang W J,Wei M,et al.The technical approaches of improving the plant salt-resistant ability[J].Chinese Agricultural Science Bulletin,2006,22(1):88-91.)
[27]Kereszt A,Li D,Indrasumunar A,et al.Agrobacterium rhizogenes-mediated transformation of soybean to study root biology[J].Nature Protocols,2007,2(4):948-952.
[28]陈敏,王和勇,廖志华,等.发根农杆菌介导的药用植物遗传进展[J].天然产物研究与开发,2000,12(3):98-102.(Chen M,Wang H Y,Liao Z H,et al.Review of studies on medicinal plants transformed by Agrobacterium rhizogenes[J].Natural Product Research and Development,2000,12(3):98-102.)
[29]Petit A,David C,Dahl G A,et al.Further extension of the opine concept:plasmids in Agrobacterium rhizogenes?cooperate for opine degradation[J].Molecular and General Genetics,1983,190(2):204-214.
[30]Blumwald E,Poole R J.Na+/H+ antiporter in isolated tonoplast vesicles from storage tissue of Beta vulgaris [J].Plant Physiology,1985,78(1):163-167.
[31]Repishti M,Hogan D L,Pratha V,et al.Human duodenal mucosal brush border Na^+/H^+ exchangers NHE2 and NHE3 alter net bicarbonate movement[J].American Journal of Physiology,2001,281(1):159-163.
[32]Staal M,Maathuis F J M,ElzengaJ T M,et al.Na+/H^+ antiport activity in tonoplast vesicles from roots of the salt-tolerant Plantago maritima?and the salt-sensitive Plantago media[J].Physiologia Plantarum,1991,82(2):179-184.

相似文献/References:

[1]刘章雄,李卫东,孙石,等.1983～2010年北京大豆育成品种的亲本地理来源及其遗传贡献[J].(darticle.aspx?type=view&id=201301001)大豆科学,2013,32(01):1.[doi:10.3969/j.issn.1000-9841.2013.01.002]
LIU Zhang-xiong,LI Wei-dong,SUN Shi,et al.Geographical Sources of Germplasm and Their Nuclear Contribution to Soybean Cultivars Released during 1983 to 2010 in Beijing[J].Soybean Science,2013,32(06):1.[doi:10.3969/j.issn.1000-9841.2013.01.002]
[2]李彩云,余永亮,杨红旗,等.大豆脂质转运蛋白基因GmLTP3的特征分析[J].(darticle.aspx?type=view&id=201301002)大豆科学,2013,32(01):8.[doi:10.3969/j.issn.1000-9841.2013.01.003]
LI Cai-yun,YU Yong-liang,YANG Hong-qi,et al.Characteristics of a Lipid-transfer Protein Gene GmLTP3 in Glycine max[J].Soybean Science,2013,32(06):8.[doi:10.3969/j.issn.1000-9841.2013.01.003]
[3]王明霞,崔晓霞,薛晨晨,等.大豆耐盐基因GmHAL3a的克隆及RNAi载体的构建[J].(darticle.aspx?type=view&id=201301003)大豆科学,2013,32(01):12.[doi:10.3969/j.issn.1000-9841.2013.01.004]
WANG Ming-xia,CUI Xiao-xia,XUE Chen-chen,et al.Cloning of Halotolerance 3 Gene and Construction of Its RNAi Vector in Soybean (Glycine max)[J].Soybean Science,2013,32(06):12.[doi:10.3969/j.issn.1000-9841.2013.01.004]
[4]张春宝,李玉秋,彭宝,等.线粒体ISSR与SCAR标记鉴定大豆细胞质雄性不育系与保持系[J].(darticle.aspx?type=view&id=201301005)大豆科学,2013,32(01):19.[doi:10.3969/j.issn.1000-9841.2013.01.005]

ZHANG Chun-bao, LI Yu-qiu, PENG Bao, et al. Identification of Soybean Cytoplasmic Male Sterile Line and Maintainer Line with Mitochondrial ISSR and SCAR Markers[J]. Soybean Science, 2013, 32(06): 19. [doi: 10.3969/j.issn.1000-9841.2013.01.005]
[5]卢清瑶, 赵琳, 李冬梅, 等. RAV基因对拟南芥和大豆不定芽再生的影响[J]. (darticle.aspx?type=view&id=201301006)大豆科学, 2013, 32(01): 23. [doi: 10.3969/j.issn.1000-9841.2013.01.006]
LU Qing-yao, ZHAO Lin, LI Dong-mei, et al. Effects of RAV gene on Shoot Regeneration of Arabidopsis and Soybean [J]. Soybean Science, 2013, 32(06): 23. [doi: 10.3969/j.issn.1000-9841.2013.01.006]
[6]杜景红, 刘丽君. 大豆fad3c基因沉默载体的构建[J]. (darticle.aspx?type=view&id=201301007)大豆科学, 2013, 32(01): 28. [doi: 10.3969/j.issn.1000-9841.2013.01.007]
DU Jing-hong, LIU Li-jun. Construction of fad3c Gene Silencing Vector in Soybean[J]. Soybean Science, 2013, 32(06): 28. [doi: 10.3969/j.issn.1000-9841.2013.01.007]
[7]张力伟, 樊颖伦, 牛腾飞, 等. 大豆“冀黄13”突变体筛选及突变体库的建立[J]. (darticle.aspx?type=view&id=201301008)大豆科学, 2013, 32(01): 33. [doi: 10.3969/j.issn.1000-9841.2013.01.008]
ZHANG Li-wei, FAN Ying-lun, NIU Teng-fei?, et al. Screening of Mutants and Construction of Mutant Population for Soybean Cultivar "Jihuang13" [J]. Soybean Science, 2013, 32(06): 33. [doi: 10.3969/j.issn.1000-9841.2013.01.008]
[8]盖江南, 张彬彬, 吴瑶, 等. 大豆不定胚悬浮培养基因型筛选及基因枪遗传转化的研究[J]. (darticle.aspx?type=view&id=201301009)大豆科学, 2013, 32(01): 38. [doi: 10.3969/j.issn.1000-9841.2013.01.009]
GAI Jiang-nan, ZHANG Bin-bin, WU Yao, et al. Screening of Soybean Genotypes Suitable for Suspension Culture with Adventitious Embryos and Genetic Transformation by Particle Bombardment[J]. Soybean Science, 2013, 32(06): 38. [doi: 10.3969/j.issn.1000-9841.2013.01.009]
[9]王鹏飞, 刘丽君, 唐晓飞, 等. 适于体细胞胚发生的大豆基因型筛选[J]. (darticle.aspx?type=view&id=201301010)大豆科学, 2013, 32(01): 43. [doi: 10.3969/j.issn.1000-9841.2013.01.010]
WANG Peng-fei, LIU Li-jun, TANG Xiao-fei, et al. Screening of Soybean Genotypes Suitable for Somatic Embryogenesis [J]. Soybean Science, 2013, 32(06): 43. [doi: 10.3969/j.issn.1000-9841.2013.01.010]
[10]刘德兴, 年海, 杨存义, 等. 耐酸铝大豆品种资源的筛选与鉴定[J]. (darticle.aspx?type=view&id=201301011)大豆科学, 2013, 32(01): 46. [doi: 10.3969/j.issn.1000-9841.2013.01.011]
LIU De-xing, NIAN Hai, YANG Cun-yi, et al. Screening and Identifying Soybean Germplasm Tolerant to Acid Aluminum [J]. Soybean Science, 2013, 32(06): 46. [doi: 10.3969/j.issn.1000-9841.2013.01.011]
[11]许娜, 闫强, 崔晓霞, 等. 发根农杆菌介导的大豆DAD基因沉默嵌合植株的获得[J]. (darticle.aspx?type=view&id=201504006)大豆科学, 2015, 34(04): 576. [doi: 10.11861/j.issn.1000-9841.2015.04.0576]
XU Na, YAN Qiang, CUI Xiao-xia, et al. Agrobacterium-mediated GmDAD1 Gene Silence of Transgenic Hairy Roots in Chimeric Soybean[J]. Soybean Science, 2015, 34(06): 576. [doi: 10.11861/j.issn.1000-9841.2015.04.0576]

备注/Memo 基金项目：国家大豆产业技术体系建设专项（CARS-04）；国家转基因生物新品种培育重大专项（2008ZX08010-004）。
第一作者简介：王敏娟（1984-），女，硕士，研究方向为大豆生物技术。E-mail: fox0613@126.com。
通讯作者：韩天富（1963-），博士，研究员，从事大豆遗传育种与生物技术研究。E-mail: hantf@mail.caas.net.cn。林汉明（1960-），博士，教授，从事植物分子生物学和农业生物技术研究。E-mail: honming@cuhk.edu.hk。

更新日期/Last Update: 2014-08-16