**Electronic Supplementary Information for** 

## Characterizing the Uptake, Accumulation and Toxicity of Silver Sulfide

## Nanoparticles in Plants†

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## Summary

13 pages, including 2 tables and 9 figures.

 Table S1. Primer sets used in the present study.

GeneNamePrimersCucumber aquaporinsCsaActin5'-GCTGGATTCTGGTGATGGTGTGAG-3' and 5'-TCCGCCACCGATGGTGAACATG-3'CsaPIP1;15'-TCCGCCACCGATGCTAAGAGAA-3' and 5'-AAGCGTGTTGCCTGTGTAGATGAT-3'CsaPIP1;25'-ACCGTCTTCTCCGCCACTGAT-3' and 5'-TTCCGGCGTTGGCTTGGTTAAG-3' and 5'-TTCCTGGCGTTTGCTCTGGGATCA-3'CsaPIP2.15'-TCCCGCCACTGATCAGAGAA-3'CsaPIP2.25'-TACTGTCTTCTCCGCCACTGATCC-3' and 5'-TGTTGTGTGTTGATGACGGCAGGAC-3'CsaPIP2.35'-TGTGGCTTGGCATTGGTGAAGG-3' and 5'-TCTTTCTCGGCATCGGTAGGGAAA-3'CsaPIP2.55'-TCTTTCTCCGCCACCGATTCCAA-3' and 5'-GCCCAACCCAGAATTATCCAATGGT-3'Wheat aquaporins7aActinTaActin5'-TCCTGGAATTGCTGATGCAAGGAC-3' 3'-GCCCAACCCAGAATATCCAAAGGACA-3' and 5'-GCCCATCGTAACTCGCATGAGACA-3' and 5'-GCCCATCGTAACTCGTACGCATGAG-3' and 5'-GCCCATCGTAACTCCGCCTTGG-3'Wheat aquaporinsTaActinS'-GCGCGCTCCAGCAACAAGGACAA-3' and 5'-GCCGCGCTCCAGCAACAAGGACAA-3' and 5'-GCCGCGCCTCCAGCAA-3' and 5'-GCGGCGTAGTAGTGTTGCTAACAG-3'TaPIP15'-GCGGCGTAGTAGATGTTGTCT-3' and 5'-GCTGGCTGCTACTGTGCGCATT-3'TaAQP15'-GACCAAGCCCTCCAAGCCAACGAAACAACACA-3' and 5'-CCGTGGCTCCGATCAACGAAGAA-3' and 5'-CCGTGGCTGCAATCTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa3M164580Cucumber telhed genesCsa3M164580Cucumber ctatagaaS'-GGCGCTGCAACGAGCAACATCA-3'CacaM001970S'-GGCCTCGGATGAACACCTCCGAAGA-3' and 5'-GCCCGCAGCAGCGCGAGAGAACACACCCCGAAGACAA-3'Cucumber cthylene signalling pathway related genesCsa3M164580Cucumber cthylene signa		1	1			
Cucumber aquaporinsCsaActin5'-GCTGGATTCTGGTGATGGTGAGAGA-3' and 5'-TTCGGCCACTGATGGTGACACATG-3'CsaPIP1;15'-TCCGCCACTGGTGTGAACATG-3'CsaPIP1;25'-ACCGTCTTCTCCGCCACTGAT-3' and 5'-ATCCCACGCTTTGTCCTTGTGATAAG-3'CsaPIP2.15'-TTGCGGCTGGCTTGGTTAAAG-3' and 5'-TCTCTGGGCTTTCTCTGGGATCA-3'CsaPIP2.25'-TCTCTGGGCTTGCTTGTGAAAG-3' and 5'-TCTTGGGCTTGCCACTGATCC-3' and 5'-TGTTGTGATGATGACGGCAGGACA-3'CsaPIP2.35'-TGTGGCTGTGCATTGGTGAAGG-3' and 5'-TCTTCTGGGATCGGAAGGATAAG'CsaPIP2.55'-TCTTCTCGGCACCGATTCCAA-3'CsaPIP2.65'-GCCCAACCCAGATTCCAA-3' and 5'-CCTGTGATGGGAATGGTTGCTAGAT-3'Wheat aquaporins5'-TCCTGGAATTGCTGAACGACAA-3' and 5'-GCCATTGCTCAGCATGGCAACGACAA-3' and 5'-GCCATTGCTCAGCATGGCAACACA-3' and 5'-GCCATTGCTCAGCATGCGCATGAG-3'TaPIP15'-CGCCGTCATCCAACAGGACAAA-3' and 5'-GCCGTCATCCAGCATGCGAAGCAAAGACAG-3'TaPIP25'-AAGAAACGCCGCTCCAGCAACACA-3' and 5'-GCCGGCGTACTTGCCAACACAG-3' and 5'-GCCGGCGTACTTGCCAACACAA-3' and 5'-GCCGGCGTACTTGCCAACACAAGAAACACA-3'TaPIP35'-GCGGCGGTAGTAACGCGAAACAACAT-3'TaPIP35'-GCGCGCGGTAGTGATGTGTTCTT-3' and 5'-GCTGGCTCCAAGGCAAACAACACAACAACAACAACAACAACAACAAC	Gene	Name	Primers			
aquaportns5'.TTCGGCAGTGGTGGTGAACATG-3' CsaPIP1;15'.TCCGGCACCGATGCTAAGAGAA-3' and 5'.ACGGTCTTCTCGCGCACTGAT-3' and 5'.ACGGTCTTCTCCGCCACTGAT-3' and 5'.ACGGTCTTCTCCGCCACTGAT-3' and 5'.TCTCTGGGGTTGGCTTGGTTAAG-3' and 5'.TCTCTGGGCTTTCTCTCGGGATCA-3' CsaPIP2.25'.TCTCTGGGCTTTCTCTGGGATCA-3' CsaPIP2.3CsaPIP2.35'.TCTCTGGCGTTGGTTAAG-3' and 5'.TCTCTTGGGATCGTGACGGAAGG-3' and 5'.TCTTCTGGGATCGGTAGCGGAAA-3' CsaPIP2.65'.TCTTCTCGCCCACCGATTCCAA-3' and 5'.TCTTCTCGCCACCGATTCCAA-3' and 5'.CCCTGGATCGGTAGCGGAAA-3' CsaPIP2.6Wheat aquaporinsTaActin5'.TCCTGGAATGGTGATGATGAGAG-3' and 5'.CCCTGGAATTGCTACACAAGGACAA-3' CCCGTGCTCACTCACACAAGGACAA-3' and 5'.CCCCGCCCACCTACTCGACTGGCAAGGA3' and 5'.GCCATTCGTTCCACCACGAGACAA-3' and 5'.GCCATTGCTTCACACAAGGACAA-3' and 5'.GCCATGCTCACGCATGAGCAAA-3' and 5'.GCCATGCTCACGCACGCAAGCAAACAT-3'Wheat aquaporinsTaActin5'.CCCGGCCGTCACCTACACAAGGACAA-3' and 5'.GCCATGCTCACCACGCAAGCAAACAT-3'TaPIP15'.CGCCGCGCGTAGTAGATGTTGTTCTT-3' and 5'.GCCGGCGGTAGTAGATGTTGTCTT-3' and 5'.GCCGTGCTCCAACCCAAACAACAACAACAACAACAACAACAACAAC	Cucumber	CsaActin	5'-GCTGGATTCTGGTGATGGTGTGAG-3' and			
CsaPIP1;15'-TCCGCCACCGATGCTAAGAGAA-3' and 5'-AAGCGTGTTGCCTGTTGTAGATGAT-3'CsaPIP1;25'-ACCGTCTCCCGCCACTGAT-3' and 5'-TCTCTGGCGTTGGCTTGGTTAAG-3'CsaPIP2.15'-TCTCTGGCGTTGGCTTGGTTAAG-3'CsaPIP2.25'-TACTGTCTTCTCCGCCACTGATCC-3'CsaPIP2.35'-TGATGTGATGACGGCAGGAG-3' and 5'-TCTTTGGGATCGGTAGCGGAAGG-3' and 5'-TCTTTGGGATCGGTAGCGGAAGG-3' and 5'-TCTTTGGGATCGGTAGCGGAAGG-3' and 5'-TCTTTGGGATCGGTAGCGGAAGG-3' and 5'-GCCCACCCAGATTCCAA-3' and 5'-GCCCACCCAGATTCCAA-3' and 5'-GCCCACCCAGATTCCAA-3' and 5'-GCCCACCCAGATTATTGGA-3' and 5'-GCCCATCGGTGATGGTAGAGTGCTAGAG-3' and 5'-CCCTGGGATTGGGAATGGTTGGTAAGA-3' and 5'-CCCTGTGATGGGAATGGTTGGTAGAG-3' and 5'-CCCTGTGATGGGAATGGTTGGTAGAG-3' and 5'-CCCTGTGATCGCATCACCAAGGACAA-3' and 5'-GCCATTGCTCACACAAGGACAA-3' and 5'-GCCATCGCTCCAGCAA-3' and 5'-GCGATGGCTGCTACTTGCCAGCACA-3' and 5'-GCGATGGCTGCTACTTGCCAGCAACA-3' and 5'-GCGAGGCGGTAGTAGATGTTGTTCT-3' TaPIP1TaPIP15'-GCGGCGGTAGTAGATGTTGTCTT-3' TaPIP2S'-GGAGGAAACAGCAGCAAACAT-3'TaPIP35'-GGCGGCGGTAGTAGATGTTGTCTT-3' and 5'-GCTGCTGCTCCAACCAAGGAA-3' and 5'-GCTGCGTGCTACTGCGCGAAGA-3' and 5'-GCTGCGTGCTACTGTGGTCTACAACAACGAGA-3' and 5'-GCGTCTGGGTCCAAGGTCAACGAGAA-3' and 5'-GCGTCTGGGTCCAAGCTACCACACGAA-3' and 5'-GCGTCTGGGTCCAAGCTACCACACGAA-3' and 5'-CCGGTCTCGACTGAACCACACACACACAA-3' and 5'-CCGGTCTGGACGACGCGCCGAAGA-3' and 5'-CCGGTCTGGGTCCAAGCTGCCAAGCA3' and 5'-CCCGGCGTGAGAGATGACTCTGGTGGACGA-3' and 5'-CCCGGGTGGAGGAGGTGCAAGCACACAACAA-3' and 5'-CCCGGGTCGGAGGAGGATCTTACAACACCGCAACAA-3' and 5'-GGCCTGGGGTGGAGAGATCATA-3'Cucumber cthylene signalling pathway related genesCsa3M1645805'-TGCCCGACTACAGGATTCTACAGGAATA-3' CCCGGGTGAGGGTGGAGAGGATGATA-3'Cucumber cthylene s	aquaporins		5'-TTCGGCAGTGGTGGTGGAACATG-3'			
S'-AAGCGTGTTGCCTGTTGTAGATGAT-3'CsaPIP1,2S'-ACCCGTCTTCCCCGCCACTGAT-3' and S'-ATCCCACGCTTTGTCTGTGAA-3'CsaPIP2.1S'-TTGCGGCTTGTGGTTAAG-3' and S'-TCTCTGGGGTTCTCTTGGGATCA-3'CsaPIP2.2S'-TACTGTCTTCCCGCCACTGATCC-3' and S'-TCTTTGGGATCGATGCGGAAGG-3' and S'-TCTTCTCGGCATTGGTGAAGG-3' and S'-TCTTCTCGCGCACCGATTCCAA-3'CsaPIP2.3S'-TCTTGGGTCTGGCATGGGAAGG-3' and S'-TCTTCTCGGCACCGATTCCAA-3' and S'-CCTGTGATGGGAAGATATCCAA-3' and S'-GCCCAACCCAAACCACAGAATATCCAA-3' and S'-GCCCAACCCAACCAACAATGGTTGATAGA-3'Wheat aquaporinsTaActinS'-TCCTGGAATTGCTGATGGCAGAGA-3'TaPIP1S'-CCCGGCACCCCAGCAACCAACAA-3' and S'-GCCATGCTCAAGCACCAACAA-3' and S'-GCCATTGCTCAAGCACCAACAA-3' and S'-GCCATCGTCCAACCAACAAACAAGAGACAA-3' and S'-GCCATGCTCAAGCAAACAACAGAACAAACAAGAACAACAACAACAACA		CsaPIP1;1	5'-TCCGCCACCGATGCTAAGAGAA-3' and			
CsaPIP1;25'-ACCGTCTTCTCCGCCACTGAT-3' and 5'-ATCCCACGCTTTGTCCTTGTGAA-3'CsaPIP2.15'-TTCTGGGGTGGCTTGGTTAAG-3' and 5'-TCTTGGGGTTTCTTCGGGATCA-3'CsaPIP2.25'-TACTGTCTTCTCCGCCACTGATCC-3' and 5'-TGTGGCTGTGCATTGGTGAAGG3' and 5'-TCTTCTGGGATCGGTAGCGGAAGG-3' and 5'-TCTTCTGGGATCGGTAGCGGAAA-3'CsaPIP2.35'-TGTGGCTGTGCATTGGTGAAGGG3' and 5'-TCTTCTGGGATCGGTAGCGGAAA-3'CsaPIP2.55'-TCTTCTCGCCACCGATTCCAA-3' and 5'-GCCACCCAGATTATTCGAAGGT-3'Wheat aquaporinsTaActin5'-GCCGTCTTGGTGCTACAAGGTGCTGAGAGAA-3' and 5'-GCCGTCTTGCTGCTACTCGCATGAGAA-3' and 5'-GCCGTCTTACAACAAGGACAA-3' and 5'-GCCGTGCTACTACAAGAGACAA-3' and 5'-GCCGGCGGTAGTAGAGAAAACAGCAGAA-3' and 5'-GCGGGGGTGCTACTACAGCAGCAAACAT-3'Wheat aquaporinsTaActin5'-GCGCGGCGGTAGTAGAGAAA-3' and 5'-GCCGCGCGCTCCAGCAAA-3' and 5'-GCGGCGGTAGTAGAAGCGCACAACAA-3' and 5'-GCGGGGGTAGTAGAAGTTGTTCTT-3' and 5'-GCGGGGGTCGTCACAACAACAACAACAACAACAACAACAACAACAACAAC			5'-AAGCGTGTTGCCTGTTGTAGATGAT-3'			
S'-ATCCCACGCTTTGTCCTTGTTGAA-3'CsaPIP2.1S'-TTGCGGCTTGGCTTGGTTAAG-3' and S'-TCTCTGGCGTTCCTTGGCATCA-3'CsaPIP2.2S'-TACTGTCTTCTCCGCCACTGATCC-3' and S'-TGTTGTGATGATGATGACGGCAGGAC-3'CsaPIP2.3S'-TGTTGTGATGATGATGACGGCAGGAC-3'CsaPIP2.5S'-TCTTTGCGCATTGGTGAAGG-3' and S'-CCCTGTGATGGTGACGGTAGCGGAAA-3'CsaPIP2.6S'-GCCCAACCCAGAATATCCAATGGT-3'CsaPIP2.6S'-GCCTGTGATGGGAATGGTTGCTAGAT-3'Wheat aquaporinsTaActinTaPIP1S'-CGCCGTCATCTACAACAAGGACAA-3' and S'-GCCATGGTACTGCATCCACAGCAAA-3' and S'-GCCATTGCTTCAGTCTGGCATGAG-3'TaPIP2S'-AGAACTCATCGTACTCCGCCTTGG-3'TaPIP2S'-AGAACTCATCGTACTCCGCCTTGG-3'TaPIP3S'-GCCGGCGTAGTAGATGGTTGTTCTT-3' and S'-GCTGCGGTGCTACTAGCGCTCCAGCAA-3' and S'-GCTGCGGTCCAAGGTAACAACACACAACA-3' and S'-GCTGCGGTGCTACTTGTCCAGTATATG TaAQP1S'-GCCGGCGTAGTAGAACACGAGCAACACAACA3'TaAQP1S'-GACCAAGTCCTAAGCGCGCTCCT-3' and S'-CCGTGCTGTGGTCTACAACACACGAA3' and S'-CCGTGCTGTGGTCTACAACACACGA-3' and S'-CGTCTGGGTCCAAGTCCAACACACACA-3' and S'-CCGTGCTGTGGATCTACAACACACACA-3' and S'-CCGTCTCGCATCTTCATCAACAACACA-3' and S'-CCGTCTCGCATCTTCATCAACAACACACA-3' and S'-CCGTCTCGCATCTTCATGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa4M001970Cacumber ethylene csa3M164580S'-TGCCCATCACACACACCTCCTGAAGA-3' and S'-GCCCTGCGGTGGAAGGTGTAAGAGAACA-3'Csa3M878200S'-TGCTCGCTTCCACGGATTCAGAGATAA-3'Csa3M878200S'-TGCTCGATCACAGAGATAA-3'Csa3M878200S'-GCCTCGCGACCTACACACACCCCTGAAGAACACC		CsaPIP1;2	5'-ACCGTCTTCTCCGCCACTGAT-3' and			
CsaPIP2.15'-TTGCGGCTGTGGCTTGGTTAAG-3' and 5'-TCTCTGGCGTTTCTCTGGGATCA-3'CsaPIP2.25'-TACTGTCTTCTCCGCCACTGATCC-3' and 5'-TGGTGCTGTGCATTGGTGAAGG-3' and 5'-TCTCTTGGGATCGGTAAGGGAGA-3'CsaPIP2.35'-TGTGGCTGGCATTGGTGAAGG-3' and 5'-TCTCTTCGCGCACCGATTCCAA-3' and 5'-CCCTTGGGATCGGTAGCGGAAA-3'CsaPIP2.55'-TCTTTCTCCGCCACCGATTCCAA-3' and 5'-GCCCAACCCAGAATATCCAATGGT-3'Wheat aquaporinsTaActin5'-GCCCATCGTGGGAGATTGCTGAGAT-3'Wheat aquaporinsTaActin5'-GCCGTCATTGCTGAGGTGCTAGAG-3' and 5'-GCCGTCATCTACAACAAGGACAA-3' and 5'-GCCGTCATCTACAACAAGGACAA-3' and 5'-GCCGGCGGTAGTAGAGCTGCTAGAG-3'TaPIP15'-CGCCGCGCATTGCTGCATCAGGACAA-3' and 5'-GCGGCGGTAGTAGAGGTGTGTGTCTCT-3'TaPIP25'-AAGAAGCCGCCTCCAGCAAACAACAG-3'TaPIP35'-GCGGCGGTAGTAGAGTGTTGTTCTT-3' and 5'-GCTGGCTGCTACCAGGTCAAGGAGAA-3' and 5'-GCTGGCTGCTGCTACAACAACAACAACAACAACAACAACAACAACAACAAC			5'-ATCCCACGCTTTGTCCTTGTTGAA-3'			
S'-TCTCTGGCGTTTCTCTTGGGATCA-3'CsaPIP2.2S'-TACTGTTCTCGCCCACTGATCC-3' and S'-TGGTGCTGTGATGATGGCGCAGGAC-3'CsaPIP2.3S'-TGTGGCGTGCAGGAAGGA' and S'-TCTCTTGGGATCGGTAGCGGAAA-3'CsaPIP2.5S'-TCTTTCCCGCCACCGATTCCAA-3' and S'-GCCCAACCCAGAATATCCAATGGT-3'CsaPIP2.6S'-GGCTCTTGGTGCTGAGATTATTGGA-3' and S'-CCTGTGATGGGAATGGTTGCTAGAT-3'Wheat aquaporinsTaActinTaPIP1S'-CCCGCGTCATCTACAACAGGACAA-3' and S'-GCCAATCGTCAGATGCTGCTAGAT-3'TaPIP2S'-AAGAAGCCCCCCCCAGCAA-3' and S'-GCCGTCATCTACAACAAGGACAA-3' and S'-GCCGTCATCTACAACAAGGACAA-3' and S'-GCCGTCTCAGTCTGCATACACAGGACAA-3' and S'-GCCGGCGGTAGTAGATGTTGTTCTT-3' and S'-GCTGGCTGCCAGCTCAGGCTCAGGCTACTAGGAGAACAT-3'TaPIP3S'-GCGGCGGTAGTAGATGTTGTTCTT-3' and S'-GCTGCTGCTCAGCTCCAGCAA-3' and S'-GCTGCTGCGTCTACAACAACGAGAA-3' and S'-GCTGCTGCGTCTACCATACTAGAGAGAA-3' and S'-GCTGCTGCGTCTACCAACAACGAAAA-3' and S'-CCCGTGCTTCAGGCTCCAGGAAGAA-3' and S'-CCCGTGCTTCAGCGACTGCCGAAGGA-3' and S'-CCCGGACGTCTCAGCGAAGGAA-3' and S'-CCCGGACGTGCTGCGAACGAAGAA-3' and S'-CCCGGCTCTCAGCGAAGGAA-3' and S'-CCCGGACGTCTCAGCGAAGGA-3'Cucumber cluplene signalling pathway related genesCsa6M318160Cacumber clacumber clacumber clacumber clacumber csa3M878200S'-TGCCGACTACAACACCTCCGAAGAA-3' and S'-GCCCGACGAGGAGGTGAAGAACATC-3'Cucumber clacumber clacumber clacumber clacumber csa3M878200S'-TGCCCGCTCCCAACAACTCCGGAAGAAA-3' and S'-GCCCGACTACAACACTCCTGAAGAA-3' and S'-GCCCGACTACAACACTCCTGAAGAA-3' and S'-GCCCGGTGAGGGTGGAAGAAAA-3' and S'-GCCCGGTGAGAGGATTCAAGAACACCCCGAAGAA-3' and S'-GCCCGGTGAGAGGTGCAAGAACAACACCCCCAAAAA-3' and S'-GCCCGGTGCGAAGGATCAAGACTCCGAAAA-3' and S'-GCCCGGCGTGAGAGG		CsaPIP2.1	5'-TTGCGGCTGTGGCTTGGTTAAG-3' and			
CsaPIP2.25'-TACTGTCTTCTCCGCCACTGATCC-3' and 5'-TGATTGTTGATGATGACGGCAGGAC-3'CsaPIP2.35'-TGTGGCTGTGCATTGGTGAAGG-3' and 5'-TCTTTCCGCCACCGATTCCAA-3'CsaPIP2.55'-TCTTTCCGCCACCGATTCCAA-3' and 5'-GCCCAACCCAGAATATCCAATGGT-3'CsaPIP2.65'-GCCTTGGTGCTGAGATTATTGGA3' and 5'-GCCTGTGATGGGAATGGTGTGCTAGAT-3'Wheat aquaporinsTaActin5'-TCCTGGAATGCTACCGCATGAG-3' and 5'-GCCATCGTCATCGAACCAACGAGAAA-3'TaPIP15'-CCGGCGTCATCTACAACAAGGACAA-3' and 5'-GCCATTGCTCAGTCTGCGCATGAG-3' and 5'-GCCATGCTCAGTCTGCGCATACAG-3'TaPIP25'-AGAACTCATCGTACTCGCCCTGG-3'TaPIP35'-GCGGGGTAGTAGAGCAACAA-3' and 5'-GCGGGGTGGTAGTAGATGTTGTCTT-3' and 5'-GCTGGGTCCAGGTCAGGTGAACAACAACAACAA-3'TaAQP15'-GCGCGGTGGTCAACAACAACGAGAAACAT-3'TaAQP25'-CTGCTGTGGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTCCGATCATCCATACGGAACAACGA-3' and 5'-CCGTGCTGTGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTTCCGATCATCCATACGA-3' and 5'-CCGTGCTCTCGATCAACAACGAGAA-3' and 5'-CCGTGCTCTGGATCAACAACGAGAA-3' and 5'-CCGTGCTCTCGATCAACAACGAGAA-3' and 5'-CCGGCGTCGGATGATCAGGAACA-3' and 5'-CCGGGCTGTGATCTACAACAACGAACA-3' and 5'-CCGGGCTGTGATCTACAACAACGA-3' and 5'-CCGGGCTGTGATCTACAACAACGA-3' and 5'-CCCCGGAGGATGATCGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa6M3181605'-AGCTCTGGGTCGCGAGGATTCTATA-3'Cucumber ethylene signalling pathway related genesCsa3M8782005'-TGCTCGGTCGAACGAACAACTCCTGAAGA-3' and 5'-GCCCGGTGAGGGTGGTAGAGAATA-3'Csa3M8782005'-TGCTCGATCACGGATTCAGGAATTG-3' and 5'-GCCCGTCGATCACGGATTCAGGAATTG-3' and 5'-CACCTGTCTCTCTGCTGGATCCGAAGAATA-3'			5'-TCTCTGGCGTTTCTCTTGGGATCA-3'			
S'-TGATTGTTGATGATGACGGCAGGAC-3'CsaPIP2.3S'-TGTGGCTGTGCATTGGTGAAGG-3' and S'-TCTCTTGGGATCGGTAGCGGAAA-3'CsaPIP2.5S'-TCTTTCTCCGCACCGATTCCAA-3' and S'-GCCCAACCCAGAATATCCAATGGT-3'CsaPIP2.6S'-GCCTTTGGTGCTGGGAATTGCTGAGA-3' and S'-CCTGTGATGGGAATGGTTGCTAGA-3' and S'-CCTGGAATGGTACCCATGAG-3' and S'-CCTGGAATGGTACCCATGAG-3' and S'-CCCGGCATCTACAACAAGGACAA-3'Wheat aquaporinsTaActinS'-TCCTGGAATGGTACCCACGAGATATGCTAGAT-3'Wheat aquaporinsTaActinS'-CCCGGCATCTACAACAAGGACAA-3' and S'-GCCATTGCTCAGTCTGCATACAG-3'TaPIP1S'-CGCCGTCATCTACAACAAGGACAA-3' and S'-GCCGGGTGATGAGATGTGTGTTCT-3' and S'-GCTGGCGTGCTACAACAACGAAACAT-3'TaPIP3S'-GCGGGTGGTGATCAACAACGAGAAACAT-3'TaAQP1S'-GCGTGGTCGTGATCTACAACAACGAGAA-3' and S'-GCTGGGTCTGGATCTACAACAACGAGAA-3' and S'-GCTGGGTGCTACAACAACGAGAA-3' and S'-GCTGGGTGCTAGGTCTACAACAACGAGAA-3' and S'-GCTGGGTGCTACAACAACGAGAA-3' and S'-CCGTGCTTCCGATCATCCATACTG-3'TaAQP1S'-GAGCTGCTGGATCTACAACAACGAA-3' and S'-CCGTGCTTCCGATCATCCATACTG-3'TaAQP3S'-GGCTCTGGCTGTGATCTACAACAACGA-3' and S'-CCCGGAGATGTACGGCGAAGGA-3'Cucumber ethylene signalling pathway related genesS'-AGCCTCTGGGTCGACGAGGATCCTAAGGAACTA-3'Csa3M18180S'-AGCCTCTGGGTGGAGGATCCTAAGACTGGTGAAGA-3' and S'-GGCCTCTGGGTGGAGGATCCTAGGAACTA-3'Csa3M878200S'-TGGCCACCTACAACACTCCTGAAGAA-3' and S'-GCCCGATCAACGACTACGAACTA-3'Csa3M878200S'-TGCTCGATCACGGATTCAGGAATTA-3'Csa3M878200S'-TGCTCGATCACGAGATTCAGGAATAA-3'S'-GCCGGTAGAGGGTGGTAGAGAATAA-3'S'-GCCCTGGATCACGGATCACGACACACCCCACAACACCCCACACACCCACACACCTCCTGAAGAATG-3' and S'-GCCCTGCGATCACGGAGGAT		CsaPIP2.2	5'-TACTGTCTTCTCCGCCACTGATCC-3' and			
CsaPIP2.35'-TGTGGCTGTGCATTGGTGAAGG-3' and S'-TCTCTTGGGATCGGTAGCGGAAA-3'CsaPIP2.55'-TCTTCTCCGCCACCGATTCCAA-3' and S'-GCCCAACCCAGATATCCAATGGT-3'Wheat aquaporins5'-CTGTGATGGGAATGGTTGCTAGAG-3' and S'-CTGTGAATGGTACCGATGGAGATATTGGA-3' and S'-CTGTGAATGCTGATGCGATGGAGATATTGGA-3' and S'-CTGTGATGCGAATGCTGCGCATGGAG-3' and S'-CGCGTCATCTACAACAAGGACAA-3' and S'-GCCGTCATCTACAACAAGGACAA-3' and S'-GCCATTGCTTCAGTCTTGCATACAG-3'TaPIP15'-CGCGTCATCTACAACAAGGACAA-3' and S'-GCCATTGCTTCAGTCTTGCATACAG-3'TaPIP25'-AAGAAGGCCGCCTCCAGCAA-3' and S'-GCGGCGGTAGTAGAAGCAGCAAACAT-3'TaPIP35'-GCGGCGGTAGTAGAAGCAGCAAACAT-3'TaAQP15'-GCGGCGGTCTACAGGCGTCTACGGTAT-3'TaAQP25'-CTGCTGGGTCTACACAACAACGAGAA-3' and S'-CCGTGCTTCCGATCATCATCAT-3'TaAQP35'-GACCAAGTCCTAAGCCGCTCCT-3' and S'-CCGTGCTTCCGATCAACAACAACGA-3' and S'-CCGTGCTTCCGATCAACAACAACGA-3' and S'-CGCGTGGCTCTCCGATCACCATACTG-3'Cucumber ethylene signalling pathway related genesCsa6M318160S'-GCCGGGTGGAGCGAGGAGGATTCTTAT-3'Csa3M878200S'-GCCGCGTCTCACCGAACGAA-3' and S'-GCCCGCATCTACACAACACCTCCGAAGA-3' and S'-GCCCGCGTCTCCGGAGGATTCTTAT-3'			5'-TGATTGTTGATGATGACGGCAGGAC-3'			
S'-TCTCTTGGGATCGGTAGCGGAAA-3'CsaPIP2.55'-TCTTTCTCCGCCACCGATTCCAA-3' and 5'-GCCCAACCCAGATATCCAATGGT-3'Wheat aquaporinsTaActin5'-TCCTGGATGGGAATGCTGCAGAGAT-3'Wheat aquaporinsTaActin5'-TCCTGGAATGCTGACGCATGGG-3' and 5'-GCCGTCATCTACAACAGGACAA-3' and 5'-GCCATCTACAACAAGGACAA-3' and 5'-GCCATCTACAACAAGGACAA-3' and 5'-GCCATCTCAGTCTGCATACAG-3'TaPIP15'-CGCGGCGTACTACAACAGGACAA-3' and 5'-GCAGCGCGCTCCAGCAA-3' and 5'-GCGGCGGTAGTAGAGCAGCAACAT-3'TaPIP25'-AAGAAGCCGCCCCCAGCAA-3' and 5'-GCTGGCTGCTACTGTGCTATCTT-3' and 5'-GCTGGCTGCTACTGTGCGCTATT-3'TaAQP15'-GCCGGCGTCAGAGAGCAGCAACAACAT-3'TaAQP25'-CTGCTGGGTCTACAGCAGCAGCAACAACAT-3'TaAQP35'-GACCAAGTCCTAAGCCGCTCCT-3' and 5'-CGTGCTGCGTCTACAACAACAACGAGAA-3' and 5'-CCGTGCTTCCGATCATCATCATACTG-3'TaAQP45'-GGCTTCCGGACTCACACAACAACGAGAA-3'Cucumber ethylene signalling pathway related genesCsa6M318160S'-GGCTCTGGGTCGGAGGAGATCTATA-3' Csa3M8782005'-TGCCGCGTCTACACGAGATCAGAGA-3' and 5'-GCCCGATCACCGGATCAGAGA-3' and 5'-GCCCGCATCTACACAACACTCCTGAAGA-3' and 5'-GCCCGCGTCTCCGGGTCGGAGGATTCTTAT-3'		CsaPIP2.3	5'-TGTGGCTGTGCATTGGTGAAGG-3' and			
CsaPIP2.55'-TCTTCTCCGCCACCGATTCCAA-3' and 5'-GCCCAACCCAGAATATCCAATGGT-3'Wheat aquaporinsTaActin5'-GCTCTGGATGGGAATGGTTGCTAGAT-3'Wheat aquaporinsTaActin5'-TCCTGGAATTGCTGATCGCATGAG-3' and 5'-AGACTCATCGTACTCCGCCTTGG-3'TaPIP15'-CGCCGTCATCTACAACAAGGACAA-3' and 5'-GCCATTGCTTCAGTCTGCATACAG-3'TaPIP25'-AAGAAGCCGCCTCCAGCAA-3' and 5'-GGCGGTAGTAGATGTTGTCTT-3' and 5'-GCGGCGGTAGTAGATGTTGTCTT-3' and 5'-GCTGGGTGCTACTAGCGCTCCAGCAA-3' and 5'-GCTGGGTCCAGCTACTAGCGCTCT-3' and 5'-GCTGGGTCCAGGTCAAGCGCTCCT-3' and 5'-GCTGGGTCCAGGTCTACAACAACGAGAA-3' and 5'-GCTGGGTCCAGGTCTACGGTGTAT-3'TaAQP15'-GCGGCGGTAGATGTGTGTCTT-3' adACP2TaAQP25'-CTGCTGTGGTCTACAACAACGAGAA-3' and 5'-CGATCTAGCGACTGCCGAAGGA-3'TaAQP35'-GAGCTGCTGTGATCTACAACAACGAA-3' and 5'-CCCGGAGGATGTACTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa3M164580Cucumber cthal5'-GGCTCTGGGTCGGAGGATCCTATC-3' 5'-GGCCTCTGGGTCGGAGGATCGT-3'Csa3M1645805'-TGGCACCTACAACACCTCCTGAAGA-3' and 5'-CGCTGCGGTGTAGAGGATACGA-3' and 5'-CACCTGTCTTCTGCTGGATCGAAGA-3' and 5'-CACCTGTCTTCTGCTGGATCGT-3'			5'-TCTCTTGGGATCGGTAGCGGAAA-3'			
S'-GCCCAACCCAGAATATCCAATGGT-3'CsaPIP2.65'-GGCTCTTGGTGCTGAGATTATTGGA-3' and 5'-CCTGTGATGGGAATGGTTGCTAGAT-3'Wheat aquaporinsTaActin5'-TCCTGGAATTGCTGATCGCATGAG-3' and 5'-AGACTCATCGTACTCCGCCTTGG-3'TaPIP15'-CGCCGTCATCTACAACAAGGACAA-3' and 5'-GCCATTGCTTCAGTCTGCATACAG-3'TaPIP25'-AAAGAAGCCGCCCTCCAGCAA-3' and 5'-GGAAGAAACAGCAGCAAGCAAACAT-3'TaPIP35'-GGGCGGTAGTAGATGTTGTTCT-3' and 5'-GTGGGCTGCTACTAGCGCGTCT-3' and 5'-GTCTGGGTCCAGGTTCAGGTGTAT-3'TaAQP15'-GACCAAGTCCTAAGCCGCTCCT-3' and 5'-CGTGTGGTCTACAACAACAGAAACAT-3'TaAQP25'-GTCTGGGTCACATCCATACTG-3'TaAQP35'-GAGCTGCTGTGATCTACAACAACGAA-3' and 5'-CCGTGCTGTGGTCTACAACAACGA-3' and 5'-CGATCTAGCGACTGCCGAAGGA-3'Cucumber ethylene signalling pathway related genesCsa6M318160S'-GGCTCTGGGTCGGAGGAGGATGTACTGTG-3'S'-GGCTCTGGGTCGGAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATCGTG-3'Csa3M1645805'-TGGCACCTACAACACCTCCTGAAGA-3' and 5'-GCCTGCGTGTAACACACCTCCTGAAGA-3' and 5'-CACCTGTTCTTCTGCTGGATTCGT-3'		CsaPIP2.5	5'-TCTTCTCCGCCACCGATTCCAA-3' and			
CsaPIP2.65'-GGCTCTTGGTGCTGAGATTATTGGA-3' and 5'-CCTGTGATGGGAATGGTTGCTAGAT-3'Wheat aquaporinsTaActin5'-TCCTGGAATTGCTGATCGCATGAG-3' and 5'-AGACTCATCGTACTCGCCTTGG-3'TaPIP15'-CGCCGTCATCTACAACAAGGACAA-3' and 5'-GCCATTGCTTCAGTCTTGCATACAG-3'TaPIP25'-AAGAAGCCGCCCTCCAGCAA-3' and 5'-GGAAGAAACAGCAGCAAGCAAACAT-3'TaPIP35'-GCGGCGGTAGTAGAGCAGCAACAT-3'TaAQP15'-GCCGTGCTCACAGCACACGAGCAACAACAT-3'TaAQP25'-CTGCTGGGTCCAGGTTCAGAGAGAACAT-3'TaAQP25'-CTGCTGTGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTGCGTCTACAACAACGAGAA-3' and 5'-CCGTGCTGCGTCTACAACAACGAGAA-3' and 5'-CCGTGCTTCCGATCATCCATACTG-3'Cucumber ethylene signalling pathway related genesCsa4M001970Cucamber ethylene signalling pathway related genesCsa3M878200S'-GGCTCGGAGCATCAACAACGAACAA-3'S'-GGCTCTGGGTCGGAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATCGAAGAACA-3'Cucamber ethylene signalling pathway related genesS'-GGCGCGCTCGGACGCAACACACCTCTGAAGAACAACAACAACAACAACAACAACAACAACAACAAC			5'-GCCCAACCCAGAATATCCAATGGT-3'			
S'-CCTGTGATGGGAATGGTTGCTAGAT-3'Wheat aquaporinsTaActin5'-TCCTGGAATTGCTGATCGCATGAG-3' and 5'-AGACTCATCGTACTCGCCTTGG-3'TaPIP15'-CGCCGTCATCTACAACAAGGACAA-3' and 5'-GCCATTGCTTCAGTCTTGCATACAG-3'TaPIP25'-AAGAAGGCCGCCTCCAGCAA-3' and 5'-GGAAGAAACAGCAGCAAGCAAACAT-3'TaPIP35'-GCGGCGGTAGTAGATGTTGTTCTT-3' and 5'-GCTGGCTGCTACAAGCGCGCTCCT-3' and 5'-GTCTGGGTCCAAGTCTACAACGAGAA-3' and 5'-GTCTGGGTCCAAGTCTACAACGAGAA-3' and 5'-CCGTGCTGTGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTTCCGATCATCCATACTG-3'TaAQP15'-GACCAAGTCCTAAGCCGCTCCT-3' and 5'-CCGTGCTTCCGATCAACAACGAGAA-3' and 5'-CCGTGCTTCCGATCAACAACGACA-3' and 5'-CCGTGCTTCGCGTCTACAACAACGACA-3' and 5'-CCCGGAGGATGTACTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa3M18160S'-GGCTCGCGTCTCGAGTCGCGAAGGAA-3' and 5'-CACCTGTCTCTCTGCTGGATCTACAACAACGA-3' and 5'-CACCTGTTCTTCTGCTGGATCTACAACAACGA-3' and 5'-CACCTGTCTCTGCGGAGGATTCTTAT-3' and 5'-CACCTGTCTCTGCGGAGGATTCTTAT-3' and 5'-CACCTGTCTCTCTGCTGGATCGAAGA-3' and 5'-CACCTGTCTCTGCTGGATCGAAGAA-3' and 5'-CACCTGTCTCTCTGCTGGATCGAAGA-3' and 5'-CACCTGTCTCTCTGCTGAAGAAAA3'Csa3M1645805'-TGGCACCTACAACACTCCTGAAGAA-3' and 5'-GGCTGCGAGGATTCTTA-3' and 5'-GGCCGAGGATTCAAGAATTG-3' and 5'-GGCGGTGAAGGATAC-3'		CsaPIP2.6	5'-GGCTCTTGGTGCTGAGATTATTGGA-3' and			
Wheat aquaporinsTaActin5'-TCCTGGAATTGCTGATCGCATGAG-3' and 5'-AGACTCATCGTACTCCGCCTTGG-3'TaPIP15'-CGCCGTCATCTACAACAAGGACAA-3' and 5'-GCCATTGCTTCAGTCTTGCATACAG-3'TaPIP25'-AAGAAGGCCGCCTCCAGCAA-3' and 5'-GCGGCGGTAGTAGAGCAAGCAAACAT-3'TaPIP35'-GCGGCGGTAGTAGAGCAACAACAT-3'TaAQP15'-GCCGGCGGTAGTAGCCGCTCCT-3' and 5'-GCTGGGTCCAGGTTCAGGGTGTAT-3'TaAQP25'-CTGCTGGGTCCAAGCAGCAAACAACGAGAA-3' and 5'-CCGTGGTTCCGATCAACAACGAGAA-3' and 5'-CCGTGGTTCCGATCAACAACGAGAA-3' and 5'-CCGTGGTTCCGATCAACAACGAGAA-3' and 5'-CCGTGCTTCCGATCATCCATACTG-3'Cucumber ethylene signalling pathway related genesCsa6M318160S'-GGCGTCGGGAGGAGGATGTACGGAGGAGAA-3' and 5'-CACCTGTGGTCGCGAAGGATCTAC-3'Csa3M1645805'-TGGCACCTACAACAACAACGAAGA-3' and 5'-CGCGTGTGCGAGGAGATTCTTA-3' and 5'-CACCTGTTCTTCTGCTGGATCAGAACA-3' and 5'-CACCTGTTCTTCTGCTGGATCAGAACA-3' and 5'-CACCTGTTCTTCTGCTGGATCAGAACA-3' and 5'-CACCTGTTCTTCTGCTGGATCGAAGA-3' and 5'-CACCTGTTCTTCTGCTGGATCGAAGA-3' and 5'-CACCTGTCTTCTGCTGGAAGAATA-3'Csa3M1645805'-TGGCACCTACAGGAATACA3CACTCTGAAGAA-3' and 5'-GGCGTGAGGGTGAAGAATAA-3'Csa3M8782005'-TGCTCGATCACGGAATACAACACTCCTGAAGAATG-3' and 5'-GCCCGAACAACACTCCTGAAGAATAA-3'			5'-CCTGTGATGGGAATGGTTGCTAGAT-3'			
aquaporins5'-AGACTCATCGTACTCCGCCTTGG-3'TaPIP15'-CGCCGTCATCTACAACAAGGACAA-3' and 5'-GCCATTGCTTCAGTCTTGCATACAG-3'TaPIP25'-AAGAAGGCCGCCTCCAGCAA-3' and 5'-GGGGCGGTAGTAGAGCAAGCAAACAT-3'TaPIP35'-GCGGCGGTAGTAGAGCAGCAAACAT-3'TaAQP15'-GACCAAGTCCTAAGCCGCTCCT-3' and 5'-GTCTGGGTCCAGGTTCAGGTGTAT-3'TaAQP25'-CTGCTGTGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTGTGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTGTGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTGTGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTGTGGATCTACAACAACGAGA-3' and 5'-CCGGGCTGCGAGGATGTCTACAACAACGA-3' and 5'-CCGGGAGGATGTACTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa6M318160S'-AGAGCATACGATGAAGCTGCCAAG-3' and 5'-CGCGTCTGGGTCGGAGGATTCTAT-3' and 5'-CACCTGTCTCTGCTGGATCGCAAGA-3' and 5'-CCCGGGTGGAGGATGTACTGGTGGT-3'Csa3M1645805'-TGGCACCTACAACAACACCTCTGAAGA-3' and 5'-GGCGGTGAGGGTGGTAGAGATAA-3'Csa3M8782005'-TGCTCGATCACGGATTCAGGAATG-3' and 5'-GCCCGATCACACGAACTA-3'	Wheat	TaActin	5'-TCCTGGAATTGCTGATCGCATGAG-3' and			
TaPIP15'-CGCCGTCATCTACAACAAGGACAA-3' and 5'-GCCATTGCTTCAGTCTTGCATACAG-3'TaPIP25'-AAGAAGGCCGCCTCCAGCAA-3' and 5'-GGAGGAAACAGCAGCAAGCAAACAT-3'TaPIP35'-GCGGCGGTAGTAGAGATGTTGTTCTT-3' and 5'-GCTGGCTGCTACTAGGCGCTCCT-3' and 5'-GTCTGGGTCCAGGTTCAGGGTGTAT-3'TaAQP15'-GACCAAGTCCTAAGCCGCTCCT-3' and 5'-GTCTGGGTCCAGGTTCAGGAGAAACAGAACAA-3' and 5'-CCTGCTGTGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTTCCGATCATCCATACTG-3'TaAQP25'-CTGCTGTGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTTCCGATCATCCAACAACGAA-3' and 5'-CCGTGCTTCCGATCATCCAACAACGA-3' and 5'-CCCGGAGGATGTACTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa6M318160S'-GGCTCTGGGTCGGAGGATTCTTAT-3' CSa3M1645805'-AGAGCATACGAAGAGCTGCCAAG-3' and 5'-CGCCGGAGGATGTACCGGATTCTTAT-3' and 5'-GGCGTGAGGGTGAGGAGAAAA-3'Csa3M8782005'-TGCCCGATCACGGATTCAGAGAAAA-3' CGCTCTGGATCACGGATTCAACAACAACAACAACAACAACAACAACAACAACAAC	aquaporins		5'-AGACTCATCGTACTCCGCCTTGG-3'			
Image: strain		TaPIP1	5'-CGCCGTCATCTACAACAAGGACAA-3' and			
TaPIP25'-AAGAAGGCCGCCTCCAGCAA-3' and 5'-GGAAGAAACAGCAGCAAGCAAACAT-3'TaPIP35'-GCGGCGGTAGTAGATGTTGTTCTT-3' and 5'-GCTGGCTGCTACTTGTCGCTATT-3'TaAQP15'-GACCAAGTCCTAAGCCGCTCCT-3' and 5'-GTCTGGGTCCAGGTTCAGGTGTAT-3'TaAQP25'-CTGCTGTGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTGTGTGTATCAACAACGAGAA-3' and 5'-CGATCTAGCGACTGCCGAAGGA-3'TaAQP35'-GAGCTGCTGTGATCTACAACAACGA-3' and 5'-CGATCTAGCGACTGCCGAAGGA-3'TaAQP45'-GGCTTCGCCGTCTTCATGGT-3' and 5'-CCCGGAGGATGTACTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa3M18160S'-GGCTCCGGAGGATGCCGAAGGATCTATA-3'5'-CACCTGTTCTGCGGAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATCGT-3'Csa3M8782005'-TGCTCGATCACGGATTCAGGAATG-3' and 5'-CGCCGATCACGGATTCAGGAATA-3'			5'-GCCATTGCTTCAGTCTTGCATACAG-3'			
S'-GGAAGAAACAGCAGCAAGCAAACAT-3'TaPIP35'-GCGGCGGTAGTAGAAGTGTTGTTCTT-3' and 5'-GCTGGCTGCTACTGTCGCTATT-3'TaAQP15'-GACCAAGTCCTAAGCCGCTCCT-3' and 5'-GTCTGGGTCCAGGTTCAGGTGTAT-3'TaAQP25'-CTGCTGTGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTGTGATCTACAACAACGAGAA-3' and 5'-CGATCTAGCGACTGCCGAAGGA-3'TaAQP35'-GAGCTGCTGTGATCTACAACAACGA-3' and 5'-CGGTGCTCCGAGGATGTACTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa6M318160Csa3M1645805'-TGGCACCTACAACAACGAA-3' and 5'-CACCTGTGTGATCGGAGGATTCTAT-3' and 5'-CACCTGTCTCGGAGGATTCTAT-3' and 5'-CACCTGTCTCTGCGGAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATCGT-3'Csa3M1645805'-TGGCACCTACAACACTCCTGAAGA-3' and 5'-GGCGGTGAGGGTGGTAGAGATAA-3'Csa3M8782005'-TGCTCGATCACGGATTCAGGAATG-3' and 5'-CCCCGATCACGGATTCCAGGAATG-3' and 5'-GCCCGGTGAGGATTCTAT-3' and 5'-GCCGGTGAGGATTCCTGAAGA-3' and 5'-GCCGGTGAGGGTGGTAGAGATAA-3'		TaPIP2	5'-AAGAAGGCCGCCTCCAGCAA-3' and			
TaPIP35'-GCGGCGGTAGTAGATGTTGTTCTT-3' and 5'-GCTGGCTGCTACTTGTCGCTATT-3'TaAQP15'-GACCAAGTCCTAAGCCGCTCCT-3' and 5'-GTCTGGGTCCAGGTTCAGGTGTAT-3'TaAQP25'-CTGCTGTGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTGTGATCTACAACAACGAGAA-3' and 5'-CGATCTAGCGACTGCCGAAGGA-3'TaAQP35'-GAGCTGCTGTGATCTACAACAACGA-3' and 5'-CGATCTAGCGACTGCCGAAGGA-3'TaAQP45'-GGCTTCGCCGTCTTCATGGT-3' and 5'-CCCGGAGGATGTACTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa6M318160S'-AGAGCATACGATGAAGCTGCCAAG-3' and 5'-CACCTGTCTCTGCGGAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATTCGT-3'Csa3M1645805'-TGGCACCTACAACACTCCTGAAGA-3' and 5'-GGCGGTGAGGGTGGTAGAGATAA-3'Csa3M8782005'-TGCTCGATCACGGATTCAGGAATTG-3' and 5'-GCTCGATCACGGATTCAGGAATTG-3' and 5'-GCCCGATCACGGATTCAGGAATTG-3' and 5'-GCCCGATCACGAATCAGGATTCGT-3'			5'-GGAAGAAACAGCAGCAAGCAAACAT-3'			
Image: symbolS'-GCTGGCTGCTACTTGTCGCTATT-3'TaAQP1S'-GACCAAGTCCTAAGCCGCTCCT-3' and S'-GTCTGGGTCCAGGTTCAGGTGTAT-3'TaAQP2S'-CTGCTGTGGTCTACAACAACGAGAA-3' and S'-CCGTGCTGTGATCTACAACAACGA-3' and S'-CGATCTAGCGACTGCCGAAGGA-3'TaAQP3S'-GAGCTGCTGTGATCTACAACAACGA-3' and S'-CGATCTAGCGACTGCCGAAGGA-3'TaAQP4S'-GGCTTCGCCGTCTTCATGGT-3' and S'-CCCGGAGGATGTACTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa6M318160S'-AGAGCATACGATGAAGCTGCCAAG-3' and S'-ACTCCTCGCTGTCACACGAACTA-3'Csa3M164580S'-TGGCACCTACAACAACTCCTGAAGA-3' and S'-GGCGTGAGGGTGGTAGAGATACA-3'Csa3M878200S'-TGCTCGATCACGGATTCAGGAATTG-3' and S'-GCCCGATCACGGATTCAGGAATTG-3' and S'-GGCGGTGAGGGTGGTAGAGATAA-3'		TaPIP3	5'-GCGGCGGTAGTAGATGTTGTTCTT-3' and			
TaAQP15'-GACCAAGTCCTAAGCCGCTCCT-3' and 5'-GTCTGGGTCCAGGTTCAGGTGTAT-3'TaAQP25'-CTGCTGTGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTGTGATCTACAACAACGA-3' and 5'-CGATCTAGCGACTGCCGAAGGA-3'TaAQP35'-GAGCTGCTGTGATCTACAACAACGA-3' and 5'-CGATCTAGCGACTGCCGAAGGA-3'TaAQP45'-GGCTTCGCCGTCTTCATGGT-3' and 5'-CCCGGAGGATGTACTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa6M318160Signalling pathway related genesCsa4M001970Signalling pathway related genesSi-CACCTGTTCTGCGGAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATCGT-3'Csa3M164580S'-TGGCACCTACAACACTCCTGAAGA-3' and 5'-GGCGGTGAGGGTGGTAGAGATAA-3'Csa3M878200S'-TGCTCGATCACGGATTCAGGAATTG-3' and 5'-GGCCGCTTCACACGAATCA-3'			5'-GCTGGCTGCTACTTGTCGCTATT-3'			
S'-GTCTGGGTCCAGGTTCAGGTGTAT-3'TaAQP25'-CTGCTGTGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTTCCGATCATCCATACTG-3'TaAQP35'-GAGCTGCTGTGATCTACAACAACGA-3' and 5'-CGATCTAGCGACTGCCGAAGGA-3'TaAQP45'-GGCTTCGCCGTCTTCATGGT-3' and 5'-CCCGGGAGGATGTACTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa6M318160Csa3M1645805'-AGAGCATACGATGAAGCTGCCAAG-3' and 5'-CACCTGTCTCGCGGTGGGAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATCGT-3'Csa3M8782005'-TGCTCGATCACAGAATACGAAGATAA-3'Csa3M8782005'-TGCTCGATCACGGATTCAGGAATTG-3' and 5'-GCCTCTGATCACGGATTCAGGAATTG-3' and		TaAQP1	5'-GACCAAGTCCTAAGCCGCTCCT-3' and			
TaAQP25'-CTGCTGTGTGGTCTACAACAACGAGAA-3' and 5'-CCGTGCTTCCGATCATCCATACTG-3'TaAQP35'-CGAGCTGCTGTGATCTACAACAACGA-3' and 5'-CGATCTAGCGACTGCCGAAGGA-3'TaAQP45'-GGCTTCGCCGTCTTCATGGT-3' and 5'-CCCGGAGGATGTACTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa6M318160S'-GGCTCTGGGTCGGAAGGACTGCCAAG-3' and 5'-ACTCCTCGCTGTCACACGAACTA-3'Csa3M1645805'-AGGCTCTGGGTCGGAAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATTCGT-3'Csa3M1645805'-TGGCACCTACAACACTCCTGAAGA-3' and 5'-GGCGGTGAGGGTGGTAGAGATAA-3'Csa3M8782005'-TGCTCGATCACGGATTCAGGAATTG-3' and 5'-GCCCGATCACGGATTCAGGAATTG-3' and 5'-GCCGGTGAGGGTGGTAGAGATAA-3'			5'-GTCTGGGTCCAGGTTCAGGTGTAT-3'			
TaAQP35'-CCGTGCTTCCGATCATCCATACTG-3' 5'-GAGCTGCTGTGATCTACAACAACGA-3' and 5'-CGATCTAGCGACTGCCGAAGGA-3'TaAQP45'-GGCTTCGCCGTCTTCATGGT-3' and 5'-CCCGGAGGATGTACTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa6M318160Csa3M1645805'-AGAGCATCTGGTGGTAGAGATTCTTAT-3' and 5'-GGCTCTGGATCACACGAACTA-3'Csa3M8782005'-TGCTCGATCACGGATTCAGGAATTG-3' and 5'-GCTCTGGATCACGGATTCAGGAATTG-3' and 5'-GCCGGTGAGGGTGGTAGAGATAA-3'		TaAQP2	5'-CTGCTGTGGTCTACAACAACGAGAA-3' and			
TaAQP35'-GAGCTGCTGTGATCTACAACAACGA-3' and 5'-CGATCTAGCGACTGCCGAAGGA-3'TaAQP45'-GGCTTCGCCGTCTTCATGGT-3' and 5'-CCCGGAGGATGTACTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa6M318160Csa3M1645805'-AGAGCATCTGGGAGGATTCTTAT-3' and 5'-CACCTGTCGCTGGCAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATCGT-3'Csa3M1645805'-TGGCACCTACAACAACACTCCTGAAGA-3' and 5'-GGCGGTGAGGGTGGTAGAGATAA-3'Csa3M8782005'-TGCTCGATCACGGATTCAGGAATTG-3' and 5'-GCCCGATCACGGATTCAGGAATTG-3' and			5'-CCGTGCTTCCGATCATCCATACTG-3'			
TaAQP45'-CGATCTAGCGACTGCCGAAGGA-3' 5'-GGCTTCGCCGTCTTCATGGT-3' and 5'-CCCGGAGGATGTACTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa6M318160 5'-AGAGCATACGATGAAGCTGCCAAG-3' and 5'-ACTCCTCGCTGTCACACGAAGAACTA-3' 5'-GGCTCTGGGTCGGAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATTCGT-3'Csa3M1645805'-TGGCACCTACAACACTCCTGAAGA-3' and 5'-GGCGGTGAGGGTGGTAGAGATAA-3' Csa3M878200Csa3M8782005'-TGCTCGATCACGGATTCAGGAATTG-3' and 5'-GCCGATCACGGATTCAGGAATTG-3' and		TaAQP3	5'-GAGCTGCTGTGATCTACAACAACGA-3' and			
TaAQP45'-GGCTTCGCCGTCTTCATGGT-3' and 5'-CCCGGAGGATGTACTGGTGGTA-3'Cucumber ethylene signalling pathway related genesCsa6M3181605'-AGAGCATACGATGAAGCTGCCAAG-3' and 5'-ACTCCTCGCTGTCACACGAACTA-3'Csa4M001970 5'-GGCTCTGGGTCGGAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATTCGT-3'5'-CACCTGTTCTTCTGCTGGATTCGT-3' csa3M164580Csa3M164580 5'-GGCGGTGAGGGTGGTAGAGATAA-3'5'-GGCCGGTGAGGGTGGTAGAGATAA-3' csa3M878200			5'-CGATCTAGCGACTGCCGAAGGA-3'			
Cucumber ethylene signalling pathway related genesCsa6M3181605'-AGAGCATACGATGAAGCTGCCAAG-3' and 5'-ACTCCTCGCTGTCACACGAACTA-3'Csa4M001970 signalling pathway related genesS'-GGCTCTGGGTCGGAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATTCGT-3'Csa3M164580 S'-TGGCACCTACAACACTCCTGAAGA-3' and 5'-GGCGGTGAGGGTGGTAGAGATAA-3'Csa3M878200 S'-TGCTCGATCACGGATTCAGGAATTG-3' and S'-GCCGATCACGGATTCAGGAATTG-3' and		TaAQP4	5'-GGCTTCGCCGTCTTCATGGT-3' and			
Cucumber ethylene signalling pathway related genesCsa6M3181605'-AGAGCATACGATGAAGCTGCCAAG-3' and 5'-ACTCCTCGCTGTCACACGAACTA-3' 5'-GGCTCTGGGTCGGAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATTCGT-3' S'-TGGCACCTACAACACTCCTGAAGA-3' and 5'-GGCGGTGAGGGTGGTAGAGATAA-3' Csa3M878200Cucumber ethylene signalling pathway related genesCsa4M001970 5'-GGCTCTGGGTCGGAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATTCGT-3' 5'-TGGCACCTACAACACTCCTGAAGA-3' and 5'-GGCGGTGAGGGTGGTAGAGATAA-3'			5'-CCCGGAGGATGTACTGGTGGTA-3'			
ethylene signalling pathway related genes5'-ACTCCTCGCTGTCACACGAACTA-3' 5'-GGCTCTGGGTCGGAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATTCGT-3' 5'-TGGCACCTACAACACTCCTGAAGA-3' and 5'-GGCGGTGAGGGTGGTAGAGATAA-3' Csa3M878200Csa3M8782005'-TGCTCGATCACGGATTCAGGAATTG-3' and 5'-TGCTCGATCACGGATTCAGGAATTG-3' and 5'-CACCTGTTCTACAACACCACCACACACACACACACACACA	Cucumber	Csa6M318160	5'-AGAGCATACGATGAAGCTGCCAAG-3' and			
signalling pathway related genesCsa4M0019705'-GGCTCTGGGTCGGAGGATTCTTAT-3' and 5'-CACCTGTTCTTCTGCTGGATTCGT-3'Csa3M1645805'-TGGCACCTACAACACTCCTGAAGA-3' and 5'-GGCGGTGAGGGTGGTAGAGATAA-3'Csa3M8782005'-TGCTCGATCACGGATTCAGGAATTG-3' and 5'-CGCCGCTCCGATCACGGATTCAGGAATTG-3' and	ethylene		5'-ACTCCTCGCTGTCACACGAACTA-3'			
pathway related genes5'-CACCTGTTCTTCTGCTGGATTCGT-3'Csa3M1645805'-TGGCACCTACAACACTCCTGAAGA-3' and 5'-GGCGGTGAGGGTGGTAGAGATAA-3'Csa3M8782005'-TGCTCGATCACGGATTCAGGAATTG-3' and 5'-CACCTGCACCACACACGACAACACTCAGGAATTG-3' and	signalling	Csa4M001970	5'-GGCTCTGGGTCGGAGGATTCTTAT-3' and			
related genesCsa3M1645805'-TGGCACCTACAACACTCCTGAAGA-3' and 5'-GGCGGTGAGGGTGGTAGAGATAA-3'Csa3M8782005'-TGCTCGATCACGGATTCAGGAATTG-3' and 5'-CGCTCGATCACGGATTCAGGAATTG-3' and	pathway		5'-CACCTGTTCTTCTGCTGGATTCGT-3'			
State <tr< td=""><td>related genes</td><td>Csa3M164580</td><td>5'-TGGCACCTACAACACTCCTGAAGA-3' and</td></tr<>	related genes	Csa3M164580	5'-TGGCACCTACAACACTCCTGAAGA-3' and			
Csa3M878200 5'-TGCTCGATCACGGATTCAGGAATTG-3' and			5'-GGCGGTGAGGGTGGTAGAGATAA-3'			
		Csa3M878200	5'-TGCTCGATCACGGATTCAGGAATTG-3' and			
5'-(i) $1$ (i) $1$			5'-GCTGGATGTTGAGACCCACAAGAG-3'			
Csa7M405830 5'-AGGAACGACAGCCGTGTTCATTG-3' and		Csa7M405830	5'-AGGAACGACAGCCGTGTTCATTG-3' and			

	Csa2M070880	5'-CGGGAACTGGAGAAGGAAACTTGAC-3'		
		5'-GCACTCCTGGTGTTGATGGTTATGA-3' and		
		5'-CCGACGCTCTATAAGTTCCGACAA-3'		
Cucumber miraculin- like protein (MLP) genes	Csa1M043200	5'-GCGAGTACGATCTGCGTGACATC-3' and		
	Csa2M021500	5'-AAGCCAAAGCCCTTTCTCCATTCTT-3'		
		5'-TGCAACTGAGTCTGATACCGGAAGA-3' and		
		5'-AAGCCACCAGCCTCACTCCATT-3'		

Treatment	Metallic Ag	Ag <sub>2</sub> S	Ag-glutathione	R-factor				
Cucumber root								
AgNO <sub>3</sub>	10 (1.2)		90 (1.2)	0.00015				
Ag <sub>2</sub> S-NPs		94 (0.9)	6 (0.9)	0.00008				
Cucumber leaf								
AgNO <sub>3</sub>	6 (1.8)		94 (1.8)	0.00029				
Ag <sub>2</sub> S-NPs		93 (1.1)	7 (0.7)	0.00014				
Wheat root								
AgNO <sub>3</sub>	12 (0.8)		88 (0.8)	0.00006				
Ag <sub>2</sub> S-NPs		99 (0.3)	1 (0.3)	0.00006				
Wheat shoot								
AgNO <sub>3</sub>	2 (2)		98 (2)	0.00006				
Ag <sub>2</sub> S-NPs		91 (1.4)	9 (1.4)	0.00041				

**Table S2.** The percentage speciation of Ag in various tissues of cucumber and wheat plants as calculated using linear combination fitting (LCF) of the K-edge XANES spectra.

The values in brackets show the percentage variation in the calculated values. The goodness of fit is indicated by the R-factor. R factor =  $\sum i(experimental - fit)^2 / \sum i(experimental)^2$ , where the sums are over the data points in the fitting region.



1: tip, 2: edge, 3: vein, 4: mesophyll



**Figure S1.** Approximate division of leaves and concentrations of Ag in various fractions of leaves of cucumber (A, C) and wheat (B,D). Cucumber leaves were divided into four fractions: tip, edge, vein, and interveinal mesophyll tissues, while wheat leaves were evenly divided into three fractions: tip, middle, and base.



Figure S2. Ag K-edge XANES spectra of various Ag standard compounds.



**Figure S3.** Classification of PIP gene family in cucumber and wheat based on the homology of protein sequences.



**Figure S4.** Relative expression of various aquaporin genes in roots (A, C) and shoots (B, D) cucumber (A, B) and wheat (C, D). Data are means  $\pm$  SD.



**Figure S5.** Comparison of XANES spectra of Ag<sub>2</sub>S-NPs (A) and Ag-NPs (B) with those of bulk Ag<sub>2</sub>S and Ag foil.



**Figure S6.** Ag K-edge XANES spectra (A) and  $k^3$ -weighted EXAFS spectra (B) of reference Ag<sub>2</sub>S-NPs and Ag-glutathione (AgGSH).



**Figure S7.** Comparison of the XANES spectra of Ag<sub>2</sub>S-NP treated plants and those of AgNO<sub>3</sub>-treated plants.



**Figure S8.** Leaves of wheat grown in nutrient solution containing 10 mg Ag L<sup>-1</sup> as Ag<sub>2</sub>S-NPs or 0.5 mg Ag L<sup>-1</sup> as AgNO<sub>3</sub> for one week. (A, C) Light micrograph after  $\mu$ -XRF analysis, with the white box indicating the area examined by  $\mu$ -XRF. (B, D) Tricolor  $\mu$ -XRF map of Ag (red), Zn (blue), Mn (green) distribution (top panel) of leaves of wheat exposed to Ag<sub>2</sub>S-NPs (B) or AgNO<sub>3</sub> (D). (E, F) Fluorescent intensity of  $\mu$ -XRF spectra collected at 27 keV for hotspots (HS #1-3), and selected areas (A #4, #6-8) background (BG #5, #9) as shown in (B) and (D).



**Figure S9.** Relative expression of aquaporin genes in roots (A, C) and shoots (B, D) of cucumber (A, B) and wheat (C, D) exposed to  $Ag_2S$ -NPs or  $AgNO_3$  for one week. Data are means  $\pm$  SD. \* indicates significant difference compared to the control.