Supplementary Table S1. Number of up- and down-regulated DEGs responsible for amino acid, carbon and nitrogen metabolism in the roots of contrasting nitrogen efficient cotton genotypes in response to N starvation and resupply.

	XLZ-30		CCRI-69	
Amino acid metabolism	**Up**	**Down**	**Up**	**Down**
Alanine, aspartate and glutamate metabolism	2	4	3	5
Arginine biosynthesis	2	10	2	10
Cysteine and methionine metabolism	1	6	2	6
Glutathione metabolism	0	1	0	1
Glycine, serine and threonine metabolism	0	5	2	5
Histidine metabolism	0	2	0	2
Lysine degradation	2	0	2	0
Monobactam biosynthesis	0	1	0	1
Pyrimidine metabolism	0	1	0	1
Valine, leucine and isoleucine biosynthesis	0	3	0	3
Carbon metabolism				
Amino sugar and nucleotide sugar metabolism	1	1	1	0
Carbon fixation	0	1	2	0
Glyoxylate and dicarboxylate metabolism	0	2	6	0
Starch and sucrose metabolism	0	5	0	4
Glycolysis / Gluconeogenesis	1	15	4	12
Pentose phosphate pathway	0	12	0	11
Fructose and mannose metabolism	2	1	2	1
Galactose metabolism	2	1	2	1
Fatty acid elongation	1	0	1	0
Pentose and glucuronate interconversions	1	4	2	4
Phenylpropanoid biosynthesis	1	0	1	1
Nitrogen metabolism				
Nitrate reductase	0	4	0	4
Glutamine synthetase	2	6	2	4
Nitrite reductase	0	2	0	2
Glutamate synthase	0	1	0	1
Glutamate dehydrogenase	0	1	0	1
Asparagine synthetase	0	3	0	4
cytochrome b5	1	2	1	1

Supplementary Table S2. Number of up- and down-regulated DEGs responsible for amino acid, carbon and nitrogen metabolism in the shoots of contrasting nitrogen efficient cotton genotypes in response to N starvation and resupply.

	XLZ-30		CCRI-69	
Amino acid metabolism	**Up**	**Down**	**Up**	**Down**
Alanine, aspartate and glutamate metabolism	4	6	8	3
Arginine and proline metabolism	4	1	2	2
Arginine biosynthesis	5	2	6	2
Cysteine and methionine metabolism	2	7	8	1
Glycine, serine and threonine metabolism	1	3	7	0
Histidine metabolism	0	0	1	0
Lysine biosynthesis	0	1	2	0
Lysine degradation	2	0	1	0
Monobactam biosynthesis	0	0	2	0
Phenylalanine metabolism	0	0	2	0
Phenylalanine, tyrosine and tryptophan biosynthesis	0	1	8	0
Pyrimidine metabolism	0	0	1	0
Purine metabolism	1	0	0	1
Synthesis and degradation of ketone bodies	0	0	2	0
Taurine and hypotaurine metabolism	0	1	1	0
Valine, leucine and isoleucine biosynthesis	2	1	5	0
Amino sugar and nucleotide sugar metabolism	0	0	0	1
Carbon metabolism				
Carbon fixation	1	2	2	1
Cutin, suberine and wax biosynthesis	0	2	1	0
Cyanoamino acid metabolism	0	1	1	2
Fructose and mannose metabolism	0	2	2	1
Galactose metabolism	3	2	5	2
Glycolysis / Gluconeogenesis	5	5	12	5
N-Glycan biosynthesis	0	0	1	0
Oxidative phosphorylation	0	0	0	1
Pentose and glucuronate interconversions	1	5	4	12
Pentose phosphate pathway	0	2	4	0
Phenylpropanoid biosynthesis	1	2	3	1
Starch and sucrose metabolism	8	11	19	9
Nitrogen metabolism				
Nitrate reductase	0	4	2	1
Glutamine synthetase	2	1	2	1
Nitrite reductase	0	2	0	0
Glutamate synthase	0	2	0	0
Glutamate dehydrogenase	0	0	1	0
Asparagine synthetase	2	2	3	0
cytochrome b5	0	0	2	1

Supplementary Table S3. Hub genes up and down-regulated in the root of contrasting N-efficient cotton genotypes in response to N starvation and resupply.

Category	Gene ID	CCRI-69	XLZ-30
Amino acid	Ghir_D13G024390	Downregulated	Downregulated
Amino acid	Ghir_A13G023660	Downregulated	Downregulated
Amino acid	Ghir_A09G009700	Downregulated	Downregulated
Amino acid	Ghir_A13G023660	Downregulated	Downregulated
Amino acid	Ghir_D02G003120	Downregulated	Downregulated
Amino acid	Ghir_A06G006700	Downregulated	Downregulated
Amino acid	Ghir_A13G005930	Upregulated	Upregulated
Amino acid	Ghir_D09G020360	Downregulated	Downregulated
Amino acid	Ghir_A04G016360	Downregulated	Downregulated
Amino acid	Ghir_D05G014390	Downregulated	Downregulated
Amino acid	Ghir_A02G002720	Downregulated	Downregulated
Amino acid	Ghir_A13G005930	Upregulated	Upregulated
Amino acid	Ghir_D09G020360	Downregulated	Downregulated
Amino acid	Ghir_A05G038060	Downregulated	Downregulated
Amino acid	Ghir_D04G004990	Downregulated	Downregulated
Amino acid	Ghir_D09G021650	Downregulated	Downregulated
Amino acid	Ghir_A07G022270	Downregulated	Downregulated
Amino acid	Ghir_D07G022350	Upregulated	Upregulated
Amino acid	Ghir_D08G025080	Downregulated	Downregulated
Amino acid	Ghir_A08G024180	Downregulated	Downregulated
Amino acid	Ghir_D06G014880	Downregulated	Downregulated
Amino acid	Ghir_A10G012370	Downregulated	Downregulated
Amino acid	Ghir_A06G008720	Upregulated	Upregulated
Amino acid	Ghir_D02G003060	Downregulated	Downregulated
Amino acid	Ghir_D06G008920	Upregulated	Upregulated
Nitrogen	Ghir_D12G026390	Downregulated	Downregulated
Nitrogen	Ghir_D02G003120	Downregulated	Downregulated
Nitrogen	Ghir_A02G002720	Downregulated	Downregulated
Nitrogen	Ghir_A13G005930	Upregulated	Upregulated
Nitrogen	Ghir_D09G020360	Downregulated	Downregulated
Nitrogen	Ghir_A13G023660	Downregulated	Downregulated
Nitrogen	Ghir_A09G009700	Downregulated	Downregulated
Nitrogen	Ghir_D13G024390	Downregulated	Downregulated
Carbon	Ghir_D11G017390	Upregulated	Upregulated
Carbon	Ghir_A11G017320	Upregulated	Upregulated
Carbon	Ghir_D04G005980	Upregulated	Upregulated
Carbon	Ghir_D06G004020	Downregulated	Downregulated
Carbon	Ghir_A06G003910	Downregulated	Downregulated
Carbon	Ghir_A02G009250	Downregulated	Downregulated
Carbon	Ghir_D02G015800	Downregulated	Downregulated

Carbon	Ghir_A12G024710	Downregulated	Downregulated

Supplementary Table S4. Hub genes up and down-regulated in the shoot of contrasting N-efficient cotton genotypes in response to N starvation and resupply.

Category	Gene ID	CCRI-69	XLZ-30
Amino acid	Ghir_A09G021540	Upregulated	Downregulated
Amino acid	Ghir_A13G017290	Upregulated	Downregulated
Amino acid	Ghir_D13G017980	Upregulated	Downregulated
Amino acid	Ghir_D12G002180	Upregulated	Downregulated
Amino acid	Ghir_A13G023000	Downregulated	Upregulated
Amino acid	Ghir_A06G009280	Upregulated	Downregulated
Amino acid	Ghir_D06G009760	Upregulated	Downregulated
Amino acid	Ghir_A06G006700	Upregulated	Downregulated
Amino acid	Ghir_A12G011030	Upregulated	Downregulated
Amino acid	Ghir_D05G003480	Upregulated	Downregulated
Amino acid	Ghir_A12G028500	Upregulated	Downregulated
Amino acid	Ghir_A13G014560	Upregulated	Downregulated
Amino acid	Ghir_A09G009680	Upregulated	No change
Amino acid	Ghir_D09G020360	Downregulated	Upregulated
Amino acid	Ghir_A07G018740	Upregulated	Downregulated
Amino acid	Ghir_D12G028670	Upregulated	Downregulated
Amino acid	Ghir_A07G018790	Upregulated	Downregulated
Amino acid	Ghir_A07G012910	Upregulated	Downregulated
Amino acid	Ghir_A06G014110	Upregulated	Downregulated
Amino acid	Ghir_A01G011530	Upregulated	Downregulated
Amino acid	Ghir_D07G017980	Upregulated	Upregulated
Amino acid	Ghir_A09G020960	Downregulated	Upregulated
Amino acid	Ghir_A12G016440	Downregulated	No change
Amino acid	Ghir_D13G023640	Downregulated	Upregulated
Amino acid	Ghir_D06G007420	Upregulated	Downregulated
Amino acid	Ghir_D10G022890	Upregulated	Downregulated
Amino acid	Ghir_D01G022210	Upregulated	Upregulated
Amino acid	Ghir_D04G012180	Upregulated	No change
Amino acid	Ghir_A05G022930	Upregulated	Downregulated
Amino acid	Ghir_A07G002780	Upregulated	No change
Amino acid	Ghir_D07G005800	Upregulated	Downregulated
Amino acid	Ghir_D12G011120	Upregulated	Downregulated
Amino acid	Ghir_A07G017570	Upregulated	Downregulated
Amino acid	Ghir_A04G014400	Upregulated	Downregulated
Amino acid	Ghir_D05G006020	Upregulated	No change
Amino acid	Ghir_D13G024390	Upregulated	Downregulated
Amino acid	Ghir_A03G010810	Upregulated	Downregulated
Amino acid	Ghir_A09G022390	Upregulated	Downregulated

Amino acid	Ghir_D09G021650	Upregulated	Downregulated
carbon	Ghir_D10G008680	Downregulated	Upregulated
carbon	Ghir_A01G011760	Upregulated	Downregulated
carbon	Ghir_A08G009680	Upregulated	Downregulated
carbon	Ghir_D04G005320	Downregulated	No change
carbon	Ghir_A03G008550	Downregulated	Downregulated
carbon	Ghir_D13G008490	Downregulated	No change
carbon	Ghir_D01G013270	Upregulated	Downregulated
carbon	Ghir_D03G011050	Upregulated	Downregulated
carbon	Ghir_A01G020200	Upregulated	Downregulated
carbon	Ghir_D09G014570	Upregulated	Downregulated
carbon	Ghir_A02G011710	Downregulated	Upregulated
carbon	Ghir_A12G023160	Downregulated	Upregulated
carbon	Ghir_D11G006370	Upregulated	Downregulated
carbon	Ghir_D11G017960	Upregulated	Downregulated
carbon	Ghir_A13G023760	Downregulated	Upregulated
carbon	Ghir_A05G013940	No change	No change
carbon	Ghir_A13G020910	Upregulated	Downregulated
carbon	Ghir_D13G001770	Upregulated	Downregulated
carbon	Ghir_A11G017920	Upregulated	Downregulated
carbon	Ghir_D03G006990	Downregulated	Upregulated
carbon	Ghir_A03G013490	Downregulated	No change
carbon	Ghir_D12G020110	Downregulated	Upregulated
carbon	Ghir_A12G019870	Downregulated	No change
carbon	Ghir_A07G019010	Upregulated	No change
carbon	Ghir_D13G021730	Upregulated	Downregulated
carbon	Ghir_D07G019350	Upregulated	Downregulated
carbon	Ghir_A07G001840	Downregulated	No change
carbon	Ghir_A11G022120	Upregulated	No change
carbon	Ghir_A11G015470	Downregulated	Upregulated
carbon	Ghir_D09G001040	Upregulated	Downregulated
Nitrogen	Ghir_D09G020360	Downregulated	Upregulated
Nitrogen	Ghir_A09G009680	Upregulated	No change
Nitrogen	Ghir_A13G023660	Upregulated	Downregulated
Nitrogen	Ghir_A07G018790	Upregulated	Downregulated
Nitrogen	Ghir_A09G020960	Downregulated	Upregulated
Nitrogen	Ghir_D13G024390	Upregulated	Downregulated

Supplementary Table S5. Gene specific primers used for RT-qPCR.

Gene ID	Gene name	Specific primer
Ghir_A01G018110	NR-1F	TGGTATGGTATTCGAGCACCCA
Ghir_A01G018110	NR-1R	GTCGTAGATATGACCATGGAC
Ghir_A02G007870	NR-2F	TCGAAGGAGCTGAGCATTTG

Ghir_A02G007870	NR-2R	TTCGTTGTAACAATGATTCGT
Ghir_D02G003120	GS-1F	GTGGAGTTCTCTGGTACTGA
Ghir_D02G003120	GS-1R	AACGTATTCAGCGATGATCT
Ghir_A04G011580	GS-2F	ATCGATGAGAAATGATGGTGG
Ghir_A04G011580	GS-2R	GGCAGTCTCGTGAAGACCT
Ghir_A13G003840	NiR-1F	GGATTGAAGTGTTCAGATCAGAG
Ghir_A13G003840	NiR-1R	GTTCGTCCATGTCGTCAGCTTGG
Ghir_D13G004040	NiR-2F	GTATTGAAGTGTTCAGATCAGAAG
Ghir_D13G004040	NiR-2R	GTTCGTCCATGTCGTCGGCTTG
Ghir_A12G026360	GOGAT-1F	ATGAGCGTTATGGGTTGTAA
Ghir_A12G026360	GOGAT-1R	ACATCACCAACGAGATGCAA
Ghir_D06G018750	GOGAT-2F	GTGAAGCCCAGTAACACGGA
Ghir_D06G018750	GOGAT-2R	CTGAGCCATTTGATAGCTGATG
Ghir_A03G007160	GDH-1F	TCAAGGTTTCATGTGGGATGAAG
Ghir_A03G007160	GDH-1R	GTTCACCCCAAGTGTAAATGCGC
Ghir_D10G006710	GDH-2F	TCTTGCAGAGTTGAATAAAGA
Ghir_D10G006710	GDH-2R	CCATCCTCGTCAACCAAATACC
Ghir_D09G009410	ASN-1F	GACCGAAAGACTGATGACTGA
Ghir_D09G009410	ASN-1R	TAGTCTGCAACCTCCCTTGC
Ghir_D13G024390	ASN-2F	TTGTTATTTGGCTCATCAACGC
Ghir_D13G024390	ASN-2R	GTACTCCTCATACAAATGTGC
Ghir_A02G008900	Cytb5-1F	GTGACAAAGTTCATGGAAGA
Ghir_A02G008900	Cytb5-1R	GGAGCAAATTCTGAGCTGAC
Ghir_D02G009090	Cytb5-2F	GAACGTAACAAAGTTCCTGGAA
Ghir_D02G009090	Cytb5-2R	GAGCAAATTCTGAGCCGACTT
AT5G09810	Gh H 3.3-F	CCTTGTGGGTCTTTTTGAA
AT5G09810	Gh H 3.3-R	AACTGGATGTCCTTGGGC