8. LIST OF PUBLICATIONS
Publications:


GenBank Submissions:


International conferences:


R. Reddy et al, Markandeya G., Development of functional markers for drought tolerance in rice: Identification and validation of candidate genes and SNPs, Resilient Crops for Water Limited Environments Resilient crops for water limited environments, Cuernavaca Mexico, May 2004


Fig 1: Quality and Uniform concentration of recombinant plasmid preps used for EST generation
Fig 2a: Sequence chromatogram obtained through PHRED base calling from raw data obtained from MegaBace
Fig 2b: Sequence read lengths obtained on single pass sequencing of 4000 clones from *O. sativa cv* Nagina 22 library.
Fig 3: Transcript abundance of highly expressed genes from *O.sativa* cv Nagina 22 library
Fig 4: Functional classification of 589 putative stress responsive genes from *O.sativa* cv Nagina 22
Chromosomal distribution of unigene set of *O.sativa* cv Nagina 22

![Bar chart](image)

- Chromosome Number
- Number of mapped unigenes

Fig 5: Distribution of N22 unigene set on rice genome
Fig 6: Physical maps of N22 unigene set with functional annotations of SRGs mapped on chromosome 1, 2 and 3
Fig 7: Physical maps of N22 unigene set with functional annotations of SRGs mapped on chromosome 4, 5 and 6.
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Fig. 9: Physical maps of N22 unigene set with functional annotations of SRGs mapped on chromosomes 10 and 11 & 12.
Fig 10a: Rainout shelter (parking position) for field drought stress experiment showing 8 different plots used for inducing different levels of water stress

Fig 10b: Digital irrigation controls used for regulating water supply to different plots

Fig 11: Biological replicates with in each stress regime which are pooled for sampling

Fig 12a: Complete experiment setup before drought stress initiation (Day 38)

Fig 12b: Phenotypic difference reflected in plant height in different stress regimes

Fig 13: Drought stress induction in field in 4 different plot A1, A2 are shown on the top, A3 and A4 are shown in the bottom
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Fig 15: Decreased plant height with the severity of drought stress; A1, A2, A3, A4 are shown from left to right

Fig 16: A view on day 71 where A4 dried up completely and A3 started drying up

Fig 17: A view on day 75 where A3 and A4 are dried up completely

Relative Water Content of Leaves from Drought Stress Induced Plants

Fig 18: RWC of the drought stress induced rice seedlings shown from day 63 to day 74

Fig 19: Denatured agarose gel photograph of total RNA isolated from drought stress induced plants. (A) From 50 days old plants. (B) From 55 days old plants.
Fig 20: A 15.5 K chip printed on superamine substrate with low background; enlarged portion of a sub block showing uniformity of the spots.

Fig 21: A block of 324 spots (shown in white outline) printed in duplicate (shown in blue outline) with 182 clones, with uniform distance between the blocks.
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Fig 22b: A Block superimposed Cy3, Cy5 channels with 324 features with efficient gridding resulted in accurate spot detection indicated with symbol “+”.

Fig 23: Scatter plot of two channel intensities before normalization.

Fig 24a: Expression graph of spike in controls from Day 71 slides before normalization; non zero centered values are obvious from the expression plots.

Fig 24b: Post normalized expression graph of the day 71 showing zero centered values; Spike in controls are highlighted with blue color.

Fig 24c: Post normalized expression graph of the day 71 after folding the replicates with median; Expression graph with median of spike-in control shown in blue color.
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Fig 25b: Post normalized MVA plot showing spike in controls from Day 71 A2

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Fig 26a: Hierarchical clustering of genes showing different groups of genes classified based on the similarity in expression pattern from Day 71 A2, A3, and A4 samples (A partial view)

Fig 26b: Hierarchical clustering of genes showing different groups of genes classified based on the similarity in expression pattern from Day 45 to Day 71 from A3 samples (A partial view)
**Fig 27a:** K-means clustered expression graphs across the experiments from day 45 to day 75 in A2 (60%FC).

**Fig 27b:** Cluster 8 showing group of genes showing similar expression pattern from day.

**Fig 27c:** Hierarchically clustered expression map of genes from cluster 8 from day 45 to day 75 in A2 stress regimes; a partial view.

**Fig 27d:** Expression graph of cluster 9 of A2 stress regime from day 45 to day 75; genes from rice are shown in blue and genes from pearl millet are shown in red color.

**Fig 27e:** Heat map of cluster 9 of A2 stress regime (from day 45 to day 75) showing similar expression pattern.
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Fig 27g: Heat map of cluster 10 of A2 stress regime (from day 45 to day 75) showing similar expression pattern.

Fig 28a: K-means clustered expression graphs from day 45 to day 75 from A3 (40%FC).

Fig 28b: Expression graph of cluster 9 of A3 stress regime from day 45 to day 75; Genes from rice are shown in blue and genes from pearl millet are shown in red color.

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Fig 29d: Expression graph of cluster 8 of A4 stress regime from day 45 to day 75. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 29e: Expression map of cluster 8

Fig 29f: Expression graph of cluster 9 of A4 stress regime from day 45 to day 75. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 29g: Expression map of cluster 9

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Fig 30b: Expression graph of cluster 7 of A2 stress regime from day 59 to day 75 from Panicle sample. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 30c: Expression map of cluster 7

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Fig 32b: Expression graph of cluster 1 of A4 stress regime from day 59 to day 75 from Panicle sample. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 32c: Expression map of cluster 1

Fig 32d: Expression graph of cluster 5 of A4 stress regime from day 59 to day 75 from Panicle sample. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 32e: Expression map of cluster 5

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Fig 33b: Expression graph of Cluster 8 from samples A2, A3 and A4 of day 45. Genes from rice are shown in blue and genes from pearl millet are shown in red color.
Fig 33c: Expression map of Cluster 8

Fig 33d: Expression graph of Cluster 10 from samples A2, A3 and A4 of day 45. Genes from rice are shown in blue and genes from pearl millet are shown in red color.
Fig 33e: Expression map of Cluster 10
Fig 34a: K-means clustered expression graphs from leaf samples of day 52 compared among A2 (60%FC), A3 (40%FC), A4 (15%FC).

Fig 34b: Expression graph of Cluster 4 from samples A2, A3 and A4 of day 52. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 34c: Expression map of Cluster 4

Fig 34d: Expression graph of Cluster 5 from samples A2, A3 and A4 of day 52. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 34e: Expression map of Cluster 5

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Fig 34k: Expression map of Cluster 6

Fig 34l: Expression graph of Cluster 8 from samples A2, A3 and A4 of day 52. Genes from rice are shown in blue and genes from pearl millet are shown in red color.
Fig 34m: Expression map of Cluster 8

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Fig 35a: K-means clustered expression graphs from leaf samples of day 55 compared among A2 (60%FC), A3 (40%FC), A4 (15%FC).
Fig 35b: Expression graph of Cluster 7 from samples A2, A3 and A4 of day 55. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 35c: Expression map of Cluster 7

Fig 35d: Expression graph of Cluster 9 from samples A2, A3 and A4 of day 55. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 35e: Expression map of Cluster 9

Fig 35f: Expression graph of Cluster 10 from samples A2, A3 and A4 of day 55. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 35g: Expression map of Cluster 10

Fig 35h: Expression graph of Cluster 7_3 (sub cluster3 of cluster7) from samples A2, A3 and A4 of day 55. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 35i: Expression map of Cluster 7_3

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Fig 35l: Expression graph of Cluster 10_2 from samples A2, A3 and A4 of day 55. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 35m: Expression map of Cluster 10_2

Fig 35n: Expression graph of Cluster 5 from samples A2, A3 and A4 of day 55. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 35o: Expression map of Cluster 5

Fig 35p: Expression graph of Cluster 6 from samples A2, A3 and A4 of day 55. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 35q: Expression map of Cluster 6
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Fig 36b: Expression graph of Cluster 8 from samples A2, A3 and A4 of day 59. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 36c: Expression map of Cluster 8

Fig 36d: Expression graph of Cluster 10_1 from samples A2, A3 and A4 of day 59. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 36e: Expression map of Cluster 10_1
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Fig 36h: Expression graph of Cluster 10_3 from samples A2, A3 and A4 of day 59. Genes from rice are shown in blue and genes from pearl millet are shown in red color;
Fig 36i: Expression map of Cluster 10_3

Fig 36j: Expression graph of Cluster 6_1 from samples A2, A3 and A4 of day 59. Genes from rice are shown in blue and genes from pearl millet are shown in red color;
Fig 36k: Expression map of Cluster 6_1

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Fig 36m: Expression map of Cluster 6_2

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Fig 37f: Expression graph of Cluster 7 from samples A2, A3 and A4 of day 63. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 37g: Expression map of Cluster 7

Fig 37h: Expression graph of Cluster 8 from samples A2, A3 and A4 of day 63. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 37i: Expression map of Cluster 8

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Fig 38b: Expression graph of Cluster 7 from samples A2, A3 and A4 of day 67. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 38c: Expression map of Cluster 7

Fig 38d: Expression graph of Cluster 10 from samples A2, A3 and A4 of day 67. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 38e: Expression map of Cluster 10

Fig 38f: Expression graph of Cluster 8 from samples A2, A3 and A4 of day 67. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 38g: Expression map of Cluster 8

Fig 38h: Expression graph of Cluster 9 from samples A2, A3 and A4 of day 67. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 38i: Expression map of Cluster 9
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Fig 38k: Expression map of Cluster 4

Fig 38l: Expression graph of Cluster 6 from samples A2, A3 and A4 of day 67. Genes from rice are shown in blue and genes from pearl millet are shown in red color;
Fig 38m: Expression map of Cluster 6

Fig 39a: K-means clustered expression graphs from leaf samples of day 71 compared among A2 (60%FC), A3 (40%FC), A4 (15%FC).

Fig 39b: Expression graph of Cluster 10_1 from samples A2, A3 and A4 of day 71. Genes from rice are shown in blue and genes from pearl millet are shown in red color;
Fig 39c: Expression map of Cluster 10_1

Fig 39d: Expression graph of Cluster 10_2 from samples A2, A3 and A4 of day 71. Genes from rice are shown in blue and genes from pearl millet are shown in red color;
Fig 39e: Expression map of Cluster 10_2
Fig 39f: Expression graph of Cluster 8 from samples A2, A3 and A4 of day 71. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 39g: Expression map of Cluster 8

Fig 39h: Expression graph of Cluster 4_1 from samples A2, A3 and A4 of day 71. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 39i: Expression map of Cluster 4_1

Fig 39j: Expression graph of Cluster 4_2 from samples A2, A3 and A4 of day 71. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 39k: Expression map of Cluster 4_2

Fig 39l: Expression graph of Cluster 4_3 from samples A2, A3 and A4 of day 71. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 39m: Expression map of Cluster 4_3

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Fig 39p: Expression graph of Cluster 9 from samples A2, A3 and A4 of day 71. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 39q: Expression map of Cluster 9

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Fig 40b: Expression graph of Cluster 9 from samples A2, A3 and A4 of day 75. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 40c: Expression map of Cluster 9

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Fig 40l: Expression graph of Cluster 10 from samples A2, A3 and A4 of day 75. Genes from rice are shown in blue and genes from pearl millet are shown in red color; Fig 40m: Expression map of Cluster 10.

Fig 41a: K-means clustered expression graphs from panicle samples of day 59 compared among A2 (60%FC), A3 (40%FC), A4 (15%FC).

Fig 41b: Expression graph of Cluster 5 from samples A2, A3 and A4 of day 59 panicle. All the genes are from rice and shown in blue color.

Fig 41c: Expression graph of Cluster 6 from samples A2, A3 and A4 of day 59 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.
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Fig 41e: Expression graph of Cluster 9 from samples A2, A3 and A4 of day 59 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 41f: Expression graph of Cluster 7 from samples A2, A3 and A4 of day 59 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 42a: K-means clustered expression graphs from panicle samples of day 63 compared among A2 (60%FC), A3 (40%FC), A4 (15%FC).
Fig 42b: Expression graph of Cluster 5 from samples A2, A3 and A4 of day 63 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 42c: Expression graph of Cluster 9 from samples A2, A3 and A4 of day 63 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 42d: Expression graph of Cluster 10 from samples A2, A3 and A4 of day 63 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 42e: Expression graph of Cluster 8 from samples A2, A3 and A4 of day 63 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 42f: Expression graph of Cluster 4 from samples A2, A3 and A4 of day 63 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 42g: Expression graph of Cluster 6 from samples A2, A3 and A4 of day 63 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 42h: Expression graph of Cluster 7 from samples A2, A3 and A4 of day 63 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.
Fig 43a: K-means clustered expression graphs from panicle samples of day 67 compared among A2 (60%FC), A3 (40%FC), A4 (15%FC).

Fig 43b: Expression graph of Cluster 2 from samples A2, A3 and A4 of day 67 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 43c: Expression graph of Cluster 4 from samples A2, A3 and A4 of day 67 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 43d: Expression graph of Cluster 6 from samples A2, A3 and A4 of day 67 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 43e: Expression graph of Cluster 7 from samples A2, A3 and A4 of day 67 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.
Fig 43f: Expression graph of Cluster 8 from samples A2, A3 and A4 of day 67 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 43g: Expression graph of Cluster 9 from samples A2, A3 and A4 of day 67 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 43h: Expression graph of Cluster 10 from samples A2, A3 and A4 of day 67 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 44a: K-means clustered expression graphs from panicle samples of day 71 compared among A2 (60%FC), A3 (40%FC), A4 (15%FC).
Fig 44b: Expression graph of Cluster 5 from samples A2, A3 and A4 of day 71 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 44c: Expression graph of Cluster 6 from samples A2, A3 and A4 of day 71 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 44d: Expression graph of Cluster 8 from samples A2, A3 and A4 of day 71 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 44e: Expression graph of Cluster 10 from samples A2, A3 and A4 of day 71 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 44f: Expression graph of Cluster 7 from samples A2, A3 and A4 of day 71 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 44g: Expression graph of Cluster 9 from samples A2, A3 and A4 of day 71 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.
Fig 45a: K-means clustered expression graphs from panicle samples of day 75 compared among A2 (60%FC), A3 (40%FC), A4 (15%FC).

Fig 45b: Expression graph of Cluster 3 from samples A2, A3 and A4 of day 75 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 45c: Expression graph of Cluster 6_1 (sub cluster of 6) from samples A2, A3 and A4 of day 75 panicle.

Fig 45d: Expression graph of Cluster 6_2 from samples A2, A3 and A4 of day 75 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 45e: Expression graph of Cluster 8 from samples A2, A3 and A4 of day 75 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.
Fig 45f: Expression graph of Cluster 7 from samples A2, A3 and A4 of day 75 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 45g: Expression graph of Cluster 9 from samples A2, A3 and A4 of day 75 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.

Fig 45h: Expression graph of Cluster 10 from samples A2, A3 and A4 of day 75 panicle. Genes from rice are shown in blue and genes from pearl millet are shown in red color.
<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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<tbody>
<tr>
<td>Total number of readable sequences obtained</td>
<td>6694</td>
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<tr>
<td>Vector sequences</td>
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<td>Viral contaminants (Adenovirus type 2)</td>
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<tr>
<td>Highly redundant Ribosomal RNA sequence</td>
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<td>Sequences between 50-75 bp</td>
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<td>Mean average read length (bp)</td>
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<td>Number of High Quality sequences deposited in GenBank</td>
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<td>Unigenes identified by CAP3 assembly</td>
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<td>Number of unigenes found with no significant homology to the finished rice genome sequence (library contaminants)</td>
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<td>Number of rice unigenes</td>
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<tr>
<td>Number of unigenes which have no expressional evidence in rice (Novel Unigenes)</td>
<td>334</td>
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**Table 3:** Summary of EST generation and analysis
<table>
<thead>
<tr>
<th>Category</th>
<th>Number of sequences (%)</th>
<th>Number of novel sequences (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellular metabolism</td>
<td>229 (13.7)</td>
<td>25 (7.5)</td>
</tr>
<tr>
<td>Cell structure</td>
<td>51 (3.0)</td>
<td>6 (1.8)</td>
</tr>
<tr>
<td>Detoxification</td>
<td>56 (3.3)</td>
<td>8 (2.4)</td>
</tr>
<tr>
<td>Hormone response</td>
<td>17 (1.0)</td>
<td>4 (1.2)</td>
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<tr>
<td>Heat shock proteins</td>
<td>26 (1.5)</td>
<td>1 (0.3)</td>
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<tr>
<td>Osmotic protectants</td>
<td>38 (2.3)</td>
<td>4 (1.2)</td>
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<tr>
<td>Protein kinases and phosphatases</td>
<td>62 (3.7)</td>
<td>8 (2.4)</td>
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<tr>
<td>Pathogen response</td>
<td>31 (1.9)</td>
<td>3 (0.9)</td>
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<tr>
<td>Photosynthesis</td>
<td>65 (3.9)</td>
<td>10 (3.0)</td>
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<td>Protein synthesis</td>
<td>142 (8.5)</td>
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<td>Signal transduction</td>
<td>49 (2.9)</td>
<td>9 (2.7)</td>
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<tr>
<td>Transcription factors</td>
<td>95 (5.7)</td>
<td>15 (4.5)</td>
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<td>Transport</td>
<td>52 (3.1)</td>
<td>3 (0.9)</td>
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<tr>
<td>Protein degradation</td>
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<td>5 (1.5)</td>
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<tr>
<td>Secondary metabolism</td>
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<td>1 (0.3)</td>
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<td>Unknown and Unclassified</td>
<td>712 (42.5)</td>
<td>212 (63.5)</td>
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<tr>
<td>Total</td>
<td>1677</td>
<td>334</td>
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**Table 4:** Functional classification of N22 unigene sequences
Table 5: Known stress responsive genes at QTL locations in rice

<table>
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<tr>
<th>Close ID</th>
<th>Putative function</th>
<th>Chromosome</th>
<th>cM</th>
<th>Flanking marker</th>
<th>QTL acc. no.</th>
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<tbody>
<tr>
<td>NL_7_34</td>
<td>Mitogen-activated protein kinase</td>
<td>10</td>
<td>61.7-68.6</td>
<td>E10477S, R716</td>
<td>CQ577</td>
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<tr>
<td>NL_1_M20</td>
<td>Small GTP-binding protein (Rab5a)</td>
<td>12</td>
<td>108.2</td>
<td>R2292</td>
<td>CQE87, AQPZ005, AQC012, CQE83</td>
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<tr>
<td>NL_14_33</td>
<td>14-3-3 protein homologue GF14-12</td>
<td>8</td>
<td>92.2-98.6</td>
<td>R2382</td>
<td>CQE69, CQE70, CQN37, CQN38</td>
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<td>NL_40_02</td>
<td>Protein kinase</td>
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<td>104.7</td>
<td>E31112S</td>
<td>AQPZ013, AQPZ002</td>
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<tr>
<td>NL_5_B21</td>
<td>1-Aminocyclopropane-1-carboxylic oxide dehydrogenase</td>
<td>7</td>
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<td>C066268B</td>
<td>CQG5, CQN36, CQN35, CQN47</td>
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<td>NL_0_G15</td>
<td>EREBP-like protein</td>
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<td>CQE15</td>
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<td>NL_9_C09</td>
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<td>RNS2R_1_H13</td>
<td>Helicase-like transcription factor</td>
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**Table 6:** Various external spike-in controls used in microarray analysis