

Supplementary data:

Genomewide identification, classification and analysis of NAC type gene family in maize

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Table 1. Detailed information of NAC proteins in maize.

| Gene name | Sequence ID | Chromosome | Size (aa) | Mass (da) | pI |
|----------------|-------------------|------------|-----------|-----------|-------|
| <i>ZmNAC1</i> | GRMZM2G406204_P01 | 1 | 664 | 73381.29 | 5.60 |
| <i>ZmNAC2</i> | GRMZM2G025642_P01 | 1 | 362 | 39962.52 | 5.60 |
| <i>ZmNAC3</i> | GRMZM2G059428_P01 | 1 | 325 | 35641.12 | 6.72 |
| <i>ZmNAC4</i> | GRMZM2G077045_P02 | 1 | 526 | 59811.35 | 5.73 |
| <i>ZmNAC5</i> | GRMZM2G031001_P01 | 1 | 433 | 47600.36 | 5.87 |
| <i>ZmNAC6</i> | GRMZM2G011598_P01 | 1 | 373 | 40588.62 | 8.70 |
| <i>ZmNAC7</i> | GRMZM2G082709_P01 | 1 | 343 | 37371.29 | 5.56 |
| <i>ZmNAC8</i> | GRMZM2G475014_P01 | 1 | 371 | 43119.95 | 8.63 |
| <i>ZmNAC9</i> | GRMZM2G430522_P01 | 1 | 422 | 46650.57 | 7.64 |
| <i>ZmNAC10</i> | GRMZM2G430522_P03 | 1 | 418 | 46454.07 | 6.90 |
| <i>ZmNAC11</i> | GRMZM2G054252_P02 | 1 | 231 | 24712.31 | 10.52 |
| <i>ZmNAC12</i> | GRMZM2G340305_P01 | 1 | 763 | 81959.44 | 4.79 |
| <i>ZmNAC13</i> | GRMZM2G152543_P01 | 1 | 392 | 43377.75 | 8.19 |
| <i>ZmNAC14</i> | GRMZM2G031120_P01 | 1 | 326 | 35900.68 | 7.14 |
| <i>ZmNAC15</i> | GRMZM2G163251_P01 | 1 | 368 | 40721.89 | 7.66 |
| <i>ZmNAC16</i> | GRMZM2G347043_P01 | 1 | 312 | 34841.31 | 6.27 |
| <i>ZmNAC17</i> | GRMZM2G156977_P01 | 2 | 317 | 34542.94 | 7.12 |
| <i>ZmNAC18</i> | GRMZM2G178998_P01 | 2 | 344 | 39686.63 | 6.17 |
| <i>ZmNAC19</i> | AC212859.3_FGP008 | 2 | 320 | 35725.92 | 6.07 |
| <i>ZmNAC20</i> | GRMZM2G176677_P01 | 2 | 408 | 44754.26 | 5.21 |
| <i>ZmNAC21</i> | GRMZM2G176677_P04 | 2 | 168 | 19483.36 | 9.38 |
| <i>ZmNAC22</i> | GRMZM2G081930_P01 | 2 | 297 | 32549.40 | 5.62 |
| <i>ZmNAC23</i> | GRMZM2G450445_P02 | 2 | 438 | 48176.43 | 5.81 |
| <i>ZmNAC24</i> | GRMZM2G009892_P01 | 2 | 365 | 39040.61 | 6.87 |
| <i>ZmNAC25</i> | GRMZM2G099144_P01 | 2 | 362 | 39900.44 | 7.32 |
| <i>ZmNAC26</i> | GRMZM2G316840_P01 | 2 | 211 | 22834.11 | 4.93 |
| <i>ZmNAC27</i> | GRMZM2G018436_P01 | 2 | 322 | 35364.46 | 6.53 |
| <i>ZmNAC28</i> | GRMZM2G162739_P01 | 2 | 303 | 33893.14 | 5.74 |
| <i>ZmNAC29</i> | GRMZM2G008374_P02 | 2 | 409 | 45014.04 | 9.30 |
| <i>ZmNAC30</i> | GRMZM2G179049_P01 | 2 | 75 | 8080.37 | 6.82 |
| <i>ZmNAC31</i> | GRMZM2G179049_P02 | 2 | 285 | 30510.57 | 9.97 |
| <i>ZmNAC32</i> | GRMZM5G803888_P01 | 2 | 251 | 27691.89 | 9.42 |
| <i>ZmNAC33</i> | GRMZM2G166721_P01 | 3 | 436 | 48585.45 | 7.75 |
| <i>ZmNAC34</i> | GRMZM2G062650_P01 | 3 | 391 | 42132.16 | 5.81 |
| <i>ZmNAC35</i> | GRMZM2G064541_P01 | 3 | 517 | 57502.05 | 5.49 |
| <i>ZmNAC36</i> | GRMZM2G114850_P01 | 3 | 338 | 36137.31 | 9.01 |
| <i>ZmNAC37</i> | GRMZM2G139700_P01 | 3 | 368 | 38726.96 | 8.72 |
| <i>ZmNAC38</i> | AC211478.3_FGP004 | 3 | 154 | 17299.70 | 9.79 |

Table 1 (contd)

| Gene name | Sequence ID | Chromosome | Size (aa) | Mass (da) | pI |
|-----------------|-------------------|------------|-----------|-----------|-------|
| <i>ZmNAC39</i> | GRMZM2G060116_P01 | 3 | 281 | 30579.85 | 9.91 |
| <i>ZmNAC40</i> | AC203535.4_FGP002 | 3 | 246 | 26239.40 | 8.21 |
| <i>ZmNAC41</i> | GRMZM5G813651_P01 | 3 | 447 | 47279.30 | 8.98 |
| <i>ZmNAC42</i> | GRMZM2G014653_P01 | 3 | 295 | 32544.20 | 8.46 |
| <i>ZmNAC43</i> | GRMZM2G014653_P02 | 3 | 84 | 9207.58 | 6.70 |
| <i>ZmNAC44</i> | GRMZM2G014653_P03 | 3 | 202 | 22923.58 | 10.04 |
| <i>ZmNAC45</i> | GRMZM5G832473_P01 | 3 | 292 | 31208.62 | 4.88 |
| <i>ZmNAC46</i> | GRMZM2G312201_P01 | 3 | 1467 | 163163.67 | 7.05 |
| <i>ZmNAC47</i> | GRMZM2G312201_P03 | 3 | 142 | 15568.60 | 5.50 |
| <i>ZmNAC48</i> | GRMZM2G312201_P04 | 3 | 454 | 50289.66 | 8.87 |
| <i>ZmNAC49</i> | GRMZM2G122615_P01 | 3 | 329 | 36083.84 | 5.67 |
| <i>ZmNAC50</i> | GRMZM2G058518_P01 | 3 | 323 | 35357.54 | 8.96 |
| <i>ZmNAC51</i> | AC196475.3_FGP005 | 4 | 633 | 70664.03 | 4.91 |
| <i>ZmNAC52</i> | GRMZM2G069047_P01 | 4 | 379 | 41286.31 | 8.55 |
| <i>ZmNAC53</i> | GRMZM2G123246_P01 | 4 | 368 | 40610.92 | 9.31 |
| <i>ZmNAC54</i> | GRMZM2G100583_P01 | 4 | 228 | 24313.91 | 10.46 |
| <i>ZmNAC55</i> | GRMZM2G100583_P02 | 4 | 261 | 27767.57 | 11.50 |
| <i>ZmNAC56</i> | GRMZM2G125777_P01 | 4 | 665 | 71824.73 | 4.53 |
| <i>ZmNAC57</i> | GRMZM2G048826_P01 | 4 | 295 | 33128.99 | 6.26 |
| <i>ZmNAC58</i> | AC198937.4_FGP005 | 4 | 381 | 42497.73 | 7.68 |
| <i>ZmNAC59</i> | AC205484.3_FGP005 | 4 | 241 | 27460.48 | 9.04 |
| <i>ZmNAC60</i> | GRMZM5G898290_P01 | 4 | 348 | 38019.12 | 6.67 |
| <i>ZmNAC61</i> | GRMZM2G104078_P03 | 4 | 348 | 39213.10 | 5.34 |
| <i>ZmNAC62</i> | GRMZM2G062009_P01 | 4 | 294 | 31825.35 | 6.15 |
| <i>ZmNAC63</i> | GRMZM2G354151_P01 | 4 | 380 | 42773.04 | 5.73 |
| <i>ZmNAC64</i> | GRMZM2G113950_P01 | 4 | 657 | 71976.49 | 4.62 |
| <i>ZmNAC65</i> | GRMZM2G140901_P02 | 4 | 74 | 8356.49 | 4.69 |
| <i>ZmNAC66</i> | GRMZM2G140901_P01 | 4 | 298 | 32555.34 | 6.20 |
| <i>ZmNAC67</i> | GRMZM2G439903_P01 | 4 | 309 | 33841.79 | 6.34 |
| <i>ZmNAC68</i> | GRMZM2G123667_P02 | 4 | 359 | 38842.42 | 5.25 |
| <i>ZmNAC69</i> | GRMZM2G123667_P04 | 4 | 89 | 9780.49 | 4.87 |
| <i>ZmNAC70</i> | GRMZM2G336533_P01 | 5 | 436 | 48024.29 | 8.23 |
| <i>ZmNAC71</i> | GRMZM2G018553_P01 | 5 | 302 | 33831.20 | 6.56 |
| <i>ZmNAC72</i> | GRMZM2G112548_P01 | 5 | 336 | 37285.15 | 8.48 |
| <i>ZmNAC73</i> | GRMZM2G063522_P01 | 5 | 305 | 34128.76 | 8.17 |
| <i>ZmNAC74</i> | GRMZM2G389557_P01 | 5 | 268 | 30078.12 | 9.28 |
| <i>ZmNAC75</i> | GRMZM2G155816_P01 | 5 | 160 | 18646.18 | 9.22 |
| <i>ZmNAC76</i> | GRMZM2G094067_P01 | 5 | 225 | 24476.02 | 6.10 |
| <i>ZmNAC77</i> | GRMZM2G146380_P01 | 5 | 252 | 25667.09 | 6.65 |
| <i>ZmNAC78</i> | GRMZM2G038073_P01 | 5 | 399 | 44936.44 | 5.10 |
| <i>ZmNAC79</i> | GRMZM2G315140_P01 | 5 | 341 | 38719.42 | 6.01 |
| <i>ZmNAC80</i> | GRMZM2G100593_P01 | 5 | 386 | 43475.29 | 8.97 |
| <i>ZmNAC81</i> | GRMZM2G123667_P05 | 5 | 174 | 19688.69 | 9.73 |
| <i>ZmNAC82</i> | GRMZM5G857701_P01 | 5 | 296 | 32497.43 | 6.67 |
| <i>ZmNAC83</i> | GRMZM2G052239_P01 | 6 | 277 | 31005.55 | 6.59 |
| <i>ZmNAC84</i> | GRMZM2G030325_P01 | 6 | 380 | 41837.09 | 9.36 |
| <i>ZmNAC85</i> | GRMZM2G092465_P01 | 6 | 418 | 43953.52 | 6.44 |
| <i>ZmNAC86</i> | GRMZM2G092465_P03 | 6 | 185 | 20645.36 | 9.17 |
| <i>ZmNAC87</i> | GRMZM2G393433_P02 | 6 | 358 | 37895.76 | 8.71 |
| <i>ZmNAC88</i> | GRMZM2G091490_P01 | 6 | 367 | 39410.15 | 6.59 |
| <i>ZmNAC89</i> | GRMZM2G074358_P01 | 6 | 326 | 36590.37 | 6.33 |
| <i>ZmNAC90</i> | GRMZM2G041746_P02 | 6 | 369 | 41425.89 | 6.43 |
| <i>ZmNAC91</i> | GRMZM2G027309_P01 | 6 | 413 | 46759.11 | 5.31 |
| <i>ZmNAC92</i> | GRMZM2G086768_P01 | 6 | 303 | 34225.57 | 7.26 |
| <i>ZmNAC93</i> | GRMZM2G078954_P01 | 6 | 672 | 73548.08 | 9.04 |
| <i>ZmNAC94</i> | GRMZM2G379608_P01 | 6 | 264 | 29987.79 | 6.39 |
| <i>ZmNAC95</i> | GRMZM2G147867_P01 | 6 | 420 | 45153.08 | 8.35 |
| <i>ZmNAC96</i> | GRMZM2G180328_P01 | 6 | 339 | 35805.54 | 9.15 |
| <i>ZmNAC97</i> | GRMZM2G456568_P01 | 6 | 452 | 50480.27 | 4.43 |
| <i>ZmNAC98</i> | GRMZM2G465835_P01 | 6 | 272 | 30229.57 | 6.75 |
| <i>ZmNAC99</i> | GRMZM2G031200_P01 | 6 | 319 | 34619.02 | 9.22 |
| <i>ZmNAC100</i> | GRMZM2G479980_P01 | 7 | 358 | 39965.53 | 5.80 |

Table 1 (contd)

| Gene name | Sequence ID | Chromosome | Size (aa) | Mass (da) | pI |
|-----------------|-------------------|------------|-----------|-----------|-------|
| <i>ZmNAC101</i> | GRMZM2G079632_P01 | 7 | 300 | 33628.77 | 5.31 |
| <i>ZmNAC102</i> | GRMZM2G079632_P02 | 7 | 192 | 21795.82 | 9.86 |
| <i>ZmNAC103</i> | GRMZM2G159094_P01 | 7 | 419 | 46747.60 | 8.56 |
| <i>ZmNAC104</i> | GRMZM2G386163_P01 | 7 | 882 | 98205.98 | 5.64 |
| <i>ZmNAC105</i> | GRMZM2G054277_P01 | 7 | 202 | 22837.20 | 11.17 |
| <i>ZmNAC106</i> | GRMZM2G004531_P01 | 7 | 709 | 77981.64 | 4.67 |
| <i>ZmNAC107</i> | AC233865.1_FGP003 | 7 | 245 | 27690.00 | 5.33 |
| <i>ZmNAC108</i> | GRMZM5G885329_P01 | 7 | 171 | 19901.23 | 9.05 |
| <i>ZmNAC109</i> | GRMZM2G179885_P01 | 7 | 359 | 37788.42 | 8.39 |
| <i>ZmNAC110</i> | GRMZM2G179885_P03 | 7 | 410 | 43556.85 | 6.92 |
| <i>ZmNAC111</i> | GRMZM2G430849_P01 | 7 | 395 | 42079.79 | 6.89 |
| <i>ZmNAC112</i> | GRMZM2G181605_P01 | 7 | 318 | 35343.91 | 6.83 |
| <i>ZmNAC113</i> | GRMZM2G167492_P01 | 8 | 518 | 57331.85 | 5.52 |
| <i>ZmNAC114</i> | GRMZM2G109627_P01 | 8 | 398 | 42481.38 | 6.18 |
| <i>ZmNAC115</i> | GRMZM2G154182_P01 | 8 | 359 | 38523.76 | 6.91 |
| <i>ZmNAC116</i> | GRMZM2G154182_P03 | 8 | 192 | 21148.13 | 9.37 |
| <i>ZmNAC117</i> | GRMZM2G342647_P01 | 8 | 566 | 63309.32 | 5.40 |
| <i>ZmNAC118</i> | GRMZM2G112681_P01 | 8 | 494 | 54977.58 | 7.04 |
| <i>ZmNAC119</i> | GRMZM2G158204_P01 | 8 | 313 | 34826.66 | 9.62 |
| <i>ZmNAC120</i> | GRMZM2G172264_P01 | 8 | 283 | 31152.36 | 5.65 |
| <i>ZmNAC121</i> | GRMZM2G104400_P01 | 8 | 445 | 49513.16 | 4.61 |
| <i>ZmNAC122</i> | GRMZM2G134687_P01 | 8 | 425 | 45293.87 | 6.37 |
| <i>ZmNAC123</i> | GRMZM2G163841_P01 | 8 | 312 | 34295.15 | 5.94 |
| <i>ZmNAC124</i> | GRMZM2G163843_P01 | 8 | 356 | 38206.08 | 5.52 |
| <i>ZmNAC125</i> | GRMZM2G134073_P01 | 8 | 259 | 27215.57 | 8.71 |
| <i>ZmNAC126</i> | GRMZM2G068973_P01 | 8 | 308 | 34512.01 | 8.79 |
| <i>ZmNAC127</i> | GRMZM2G171395_P01 | 9 | 435 | 47060.41 | 6.25 |
| <i>ZmNAC128</i> | GRMZM2G041668_P01 | 9 | 349 | 40215.95 | 6.46 |
| <i>ZmNAC129</i> | GRMZM2G440219_P01 | 9 | 348 | 40087.78 | 6.37 |
| <i>ZmNAC130</i> | GRMZM2G163914_P02 | 9 | 612 | 66805.66 | 5.58 |
| <i>ZmNAC131</i> | GRMZM2G459156_P01 | 9 | 181 | 20503.83 | 9.51 |
| <i>ZmNAC132</i> | GRMZM2G115721_P01 | 9 | 354 | 38729.81 | 6.40 |
| <i>ZmNAC133</i> | GRMZM2G104074_P01 | 9 | 357 | 40012.39 | 6.36 |
| <i>ZmNAC134</i> | GRMZM2G042494_P01 | 9 | 241 | 26619.30 | 9.08 |
| <i>ZmNAC135</i> | GRMZM2G159500_P01 | 9 | 234 | 26422.43 | 9.81 |
| <i>ZmNAC136</i> | GRMZM2G159500_P02 | 9 | 348 | 38431.36 | 5.71 |
| <i>ZmNAC137</i> | GRMZM2G126936_P01 | 9 | 281 | 30578.82 | 9.99 |
| <i>ZmNAC138</i> | GRMZM5G894234_P01 | 9 | 361 | 40175.83 | 4.92 |
| <i>ZmNAC139</i> | GRMZM2G126817_P01 | 9 | 317 | 34853.35 | 6.21 |
| <i>ZmNAC140</i> | GRMZM2G174070_P01 | 9 | 687 | 76138.68 | 5.88 |
| <i>ZmNAC141</i> | GRMZM2G127379_P01 | 10 | 475 | 51243.50 | 5.82 |
| <i>ZmNAC142</i> | GRMZM2G083347_P01 | 10 | 259 | 27865.57 | 10.08 |
| <i>ZmNAC143</i> | GRMZM2G083347_P02 | 10 | 123 | 13179.38 | 9.93 |
| <i>ZmNAC144</i> | GRMZM2G167018_P01 | 10 | 282 | 31172.41 | 7.08 |
| <i>ZmNAC145</i> | GRMZM2G003715_P01 | 10 | 664 | 73605.64 | 4.81 |
| <i>ZmNAC146</i> | GRMZM2G435824_P01 | 10 | 349 | 38554.44 | 5.97 |
| <i>ZmNAC147</i> | GRMZM2G111770_P01 | 10 | 438 | 47660.33 | 5.55 |
| <i>ZmNAC148</i> | GRMZM2G043813_P01 | 10 | 293 | 32395.37 | 5.68 |

Table 2. Maize NAC gene-specific primers used for qRT-PCR analysis.

| ID | Gene name | Primer |
|----|-----------------|--|
| 1 | <i>ZmNAC16</i> | F: GAGCGGCAACCTGTTCGT; R: TGTCGAGGCCGCTGTACA |
| 2 | <i>ZmNAC28</i> | F: AACAAAGAAGAACGAGTGGGAGAA; R: TGCTGGGCCCATCATGTC |
| 3 | <i>ZmNAC39</i> | F: AACAAAGAAGAACGAGTGGGAGAA; R: TGGGAGGTGCTCATGTCCAT |
| 4 | <i>ZmNAC42</i> | F: TCGCCGTCCCCATCATC; R: CCGTACAGCGCCATCCTT |
| 5 | <i>ZmNAC43</i> | F: ATGCGCGTCCCCATCAT; R: AGGACGACGGGACGTACTTG |
| 6 | <i>ZmNAC44</i> | F: AAGCCGCTGGCCATCAA; R: TGCATGATCCAGTTGGTCTTCT |
| 7 | <i>ZmNAC46</i> | F: CGCCGACAGCATCACTTG; R: GCTCGAAGACGTTGTGCGATGT |
| 8 | <i>ZmNAC47</i> | F: TCTGCCCCGGCGTTGTTT; R: GCGAGCCGTTTGGGTACTT |
| 9 | <i>ZmNAC48</i> | F: CGCGGAGGATTCCATGTCTA; R: CGTAGCAATTTGTAGCTCGAAGA |
| 10 | <i>ZmNAC68</i> | F: CGCCGCACGCAAGAA; R: ACTGTGTCGTACCGCTCGATAA |
| 11 | <i>ZmNAC69</i> | F: GGTTCGCTTCCACCCACCGATGA; R: CCACTCCTTCTCCCCACCGAACGCC |
| 12 | <i>ZmNAC70</i> | F: CCGCCGCTATATATCCTTCCT; R: CGGGTTCTGCGCTGTCA |
| 13 | <i>ZmNAC71</i> | F: GGACCAGCGACCTGTTCGT; R: CATGTCGAGGCCGCTGTAC |
| 14 | <i>ZmNAC81</i> | F: CCAACTGGATCATGCACGAGTA; R: TGAGAAAGGTCATGGTGTAGTGAATT |
| 15 | <i>ZmNAC96</i> | F: AAGGGCGACAAGACCAACTG; R: ATCCAACCTGAGGCTGTTGTTT |
| 16 | <i>ZmNAC101</i> | F: CGCCGCCCGCCGGTGTCCATCATCG; R: GTCCGCGCCCGTGGCCTTCCAGTAG |
| 17 | <i>ZmNAC102</i> | F: ATGGTAGCGATGGCGGCCGTCAGC; R: CCCAGGGGTGCAAGCGGTACAGGTC |
| 18 | <i>ZmNAC126</i> | F: ATTCCATGTCTGACAGCTTCCA; R: CATGTTACCGAAGCCGTTCTG |
| 19 | <i>ZmNAC137</i> | F: AACAAAGAAGAACGAGTGGGAGAA; R: TGGGAGGTGCTCATGTCCAT |
| 20 | <i>Actin</i> | F: TGCCCCGAGGTGCTGTT; R: ATGGACGCCAGGCCGATT |