Pollen Color Morphs Takes

Various Ways Towards Fitness

INTRODUCTION

Flower color polymorphism is relatively uncommon in natural flowering plants, suggesting that maintenance of different color morphs within populations is difficult.  Pollen color also varies markedly, but the maintenance of this variation is little understood. In Campanula americana, pollen ranges from white to dark purple, with darker morphs garnering more pollinator visits and exhibiting elevated pollen performance under heat stress. To address the selective mechanisms shaping pollen-color, an F2 population segregating for pollen colour and measure correlations with floral traits, pollen attributes and plant‐level traits related to fitness. This will help determine the pigment biochemistry of color variants and evaluate maternal and paternal fitness of light and dark morphs by crossing within and between morphs. Pollen color is uncorrelated with floral traits such as petal color, pollen size, and nectar traits. This suggests that pollen color morphs can evolve independently.

METHODS

RESULTS

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | PollenColor | MeanFlwDiam | MeanFlwNum | Autonomy | Biomass | NectarVolume | NectarConc | PollenViab | PollenCount | BombusX | BombusY | BlueHeigtht | BlueHue | MeanPollDiam |
| CF2 | 0 | 23.1 | 17.00 | 0.167 | 3.2 | 0.448545511 | 53.49679219 | 0 | 170 | 0.095 | 0.241 | 34.781 | 439 | 1.125 |
| CF13 | 0 | 28.325 | 12.00 | 0.000 | 2.29 | 0.471692211 | 60.26061008 | 0.206185567 | 194 | 0.143 | 0.219 | 38.398 | 440 | 1.156 |
| CF20 | 0 | 32.29 | 13.25 | 0.462 | 2.65 | 0.277447607 | 57.45997745 | 0 | 447 | 0.107 | 0.193 | 39.000 | 432 | 1.022 |
| CF29 | 0 | 28.155 | 15.75 | 0.167 | 1.89 | 0.27869878 | 41.6986532 | 0.077192982 | 285 | 0.120 | 0.235 | 34.085 | 430 | 1.050 |
| CF45 | 0 | 28.17 | 15.25 | 0.000 | 3.36 | 0.493274945 | 37.90900444 | 0.010309278 | 97 | 0.165 | 0.294 | 32.583 | 440 | 1.138 |
| CF48 | 0 | 27.055 | NA | 0.000 | 5.69 | NA | NA | 0.027777778 | 36 | 0.156 | 0.303 | 30.564 | 438 | 1.172 |
| CF54 | 0 | 29.885 | 14.75 | 0.833 | 2.84 | 0.349702846 | 61.81610018 | 0 | 353 | 0.167 | 0.280 | 32.716 | 438 | 1.141 |
| CF85 | 0 | 26.615 | 13.75 | 0.143 | 3.93 | 0.523303097 | 72.32815302 | 0.040650407 | 246 | 0.155 | 0.221 | 34.603 | 439 | 1.152 |
| CF107 | 0 | 26.16 | 16.25 | 0.000 | 2.73 | 0.507976228 | 56.77770936 | 0.009302326 | 215 | 0.094 | 0.216 | 32.328 | 439 | 1.031 |
| CF128 | 0 | 22.905 | 6.50 | 0.714 | 2.76 | 0.544573037 | 77.09793222 | 0.108943089 | 307.5 | 0.164 | 0.269 | 30.195 | 439 | 1.170 |
| CF10 | 1 | 28.495 | 10.50 | 0.500 | 3.27 | 0.254926494 | 37.15067485 | 0.201646091 | 243 | 0.148 | 0.214 | 44.567 | 439 | 1.156 |
| CF16 | 1 | 27.9 | 17.25 | 0.000 | 2.84 | 0.487331874 | 12.75994865 | 0 | 217 | 0.115 | 0.249 | 35.766 | 433 | 1.125 |
| CF26 | 1 | 29.945 | 19.75 | 0.077 | 2.65 | 0.445730372 | 24.69157895 | 0.005649718 | 177 | 0.089 | 0.193 | 33.839 | 430 | 1.163 |
| CF40 | 1 | 21.6 | 1.33 | 0.000 | 1.04 | NA | NA | 0.06372549 | 204 | 0.086 | 0.195 | 34.498 | 441 | 1.056 |
| CF49 | 1 | 26.885 | 14.75 | 0.500 | 2.69 | 0.227087895 | 78.45730028 | 0.739130435 | 46 | 0.125 | 0.298 | 28.328 | 435 | 1.119 |
| CF51 | 1 | 27.81 | 16.33 | 0.000 | 3.81 | 0.968720676 | 42.29118502 | 0.253731343 | 268 | 0.147 | 0.219 | 33.603 | 441 | 1.146 |
| CF73 | 1 | 20.345 | 15.75 | 0.417 | 1.79 | 0.337816703 | 34.60185185 | 0.218487395 | 238 | 0.160 | 0.238 | 36.291 | 439 | 1.175 |
| CF74 | 1 | 22.87 | NA | NA | 4.37 | NA | NA | 0.055555556 | 288 | 0.210 | 0.309 | 29.830 | 438 | 1.172 |
| CF80 | 1 | 27.68 | 15.67 | 0.100 | 1.75 | 0.182671254 | 23.89726027 | 0.24137931 | 116 | 0.153 | 0.247 | 35.392 | 439 | 1.119 |
| CF97 | 1 | 32.395 | 18.50 | 0.000 | 2.98 | 0.76571786 | 32.50735294 | 0.013824885 | 217 | 0.123 | 0.225 | 34.426 | 439 | 1.163 |
| CF113 | 1 | 27.655 | 13.25 | 0.375 | 1.93 | 0.295589615 | 58.24603175 | 0.02892562 | 242 | 0.157 | 0.268 | 36.424 | 433 | 1.075 |
| CF142 | 1 | 28.355 | 15.50 | 0.000 | 3.87 | 0.474194557 | 70.43865435 | 0.12371134 | 97 | 0.065 | 0.194 | 35.309 | 427 | 1.144 |
| CF145 | 1 | 32.195 | 19.25 | 0.500 | 2.72 | 0.317797936 | 36.46653543 | 0 | 255 | 0.161 | 0.269 | 33.044 | 434 | 1.150 |
| CF146 | 1 | 29.815 | 21.00 | 0.400 | 2.66 | 0.446668752 | 62.99229692 | 0 | 223 | 0.075 | 0.240 | 30.690 | 430 | 1.144 |
| CF3 | 2 | 22.18 | 0.50 | 0.000 | 0.37 | NA | NA | 0.016806723 | 119 | 0.089 | 0.223 | 30.097 | 438 | 1.144 |
| CF4 | 2 | 30.285 | 13.25 | 0.833 | NA | 0.335001564 | 72.48926237 | 0.029304029 | 273 | 0.167 | 0.248 | 42.183 | 439 | 1.119 |
| CF14 | 2 | 28.37 | 18.67 | 0.429 | 4.69 | NA | NA | 0.007874016 | 254 | 0.175 | 0.243 | 34.782 | 439 | 1.144 |
| CF17 | 2 | 31.685 | 14.50 | 0.833 | 2.99 | 0.237410072 | 60.31515152 | 0.990506329 | 316 | 0.117 | 0.241 | 37.917 | 438 | 1.058 |
| CF24 | 2 | 28.18 | 18.00 | 0.250 | 1.96 | 0.342508602 | 58.13378995 | 0 | 357 | 0.128 | 0.238 | 33.105 | 432 | 1.128 |
| CF31 | 2 | 27.4 | 17.00 | NA | 2.83 | NA | NA | 0.975609756 | 164 | 0.085 | 0.230 | 36.390 | 431 | 1.113 |
| CF33 | 2 | 29.69 | 19.25 | 0.364 | 3.17 | 0.561463872 | 58.39509749 | 0 | 315 | 0.090 | 0.239 | 32.891 | 438 | 1.219 |
| CF34 | 2 | 15.29 | 23.00 | 0.500 | 3.09 | 0.542383485 | 59.99907728 | 0.165137615 | 218 | 0.171 | 0.230 | 42.418 | 439 | 1.225 |
| CF36 | 2 | 26.655 | 9.75 | 0.833 | 3.14 | 0.46668752 | 63.42627346 | 0 | 174 | 0.128 | 0.235 | 34.094 | 439 | 1.138 |
| CF39 | 2 | 26.985 | 6.75 | 0.833 | 2.17 | 0.414451048 | 52.4309434 | 0 | 252 | 0.198 | 0.250 | 36.503 | 440 | 1.056 |
| CF61 | 2 | 26.22 | 20.00 | 0.143 | 3.51 | NA | NA | 0.216828479 | 309 | 0.100 | 0.244 | 31.319 | 439 | 1.106 |
| CF62 | 2 | 26.075 | 11.25 | 0.571 | 3.94 | 0.438848921 | 43.34754098 | 0.098522167 | 203 | 0.129 | 0.251 | 33.806 | 438 | 1.158 |
| CF82 | 2 | 26.225 | 3.50 | 0.429 | 1.03 | 0.120738192 | 56.20725389 | 0.035087719 | 285 | 0.160 | 0.257 | 28.003 | 441 | 1.131 |
| CF90 | 2 | 30.25 | 10.25 | 0.667 | 3.02 | 0.416015014 | 69.69022556 | 0 | 359 | 0.128 | 0.311 | 28.042 | 438 | 1.194 |
| CF101 | 2 | 27.385 | 15.33 | 0.333 | 2.64 | 0.248045042 | 63.44136192 | 0.009433962 | 212 | 0.147 | 0.245 | 30.886 | 441 | 1.106 |
| CF112 | 2 | 27.6 | 22.00 | 0.462 | 3.44 | 0.472317798 | 63.86013245 | 0.028037383 | 321 | 0.125 | 0.240 | 37.018 | 438 | 1.263 |
| CF120 | 2 | 26.595 | 14.75 | 0.571 | 3.13 | 0.464185174 | 62.64177898 | 0 | 289 | 0.119 | 0.253 | 33.197 | 438 | 1.222 |
| CF124 | 2 | 30.395 | 12.25 | 0.333 | 2.76 | 0.179230529 | 65.65759162 | 0 | 387 | 0.137 | 0.224 | 43.816 | 431 | 1.163 |
| CF125 | 2 | 25.575 | 19.25 | 1.000 | 3.89 | 0.341257429 | 68.60678277 | 0.448051948 | 154 | 0.169 | 0.291 | 37.028 | 439 | 1.147 |
| CF129 | 2 | 28.72 | 19.00 | 0.462 | 2.74 | 0.377228652 | 55.45605307 | 0 | 369 | 0.133 | 0.271 | 30.671 | 435 | 1.159 |
| CF134 | 2 | 31.235 | 18.00 | 0.417 | 2.93 | 0.534876447 | 71.0877193 | 0 | 256 | 0.162 | 0.253 | 29.062 | 439 | 1.156 |
| CF135 | 2 | 30.31 | 17.75 | 0.333 | 3.04 | 0.429777917 | 50.88209607 | 0.325581395 | 64.5 | 0.114 | 0.285 | 20.782 | 438 | 1.249 |
| CF148 | 2 | 25.85 | 14.25 | 1.000 | 2.98 | 0.287769784 | 46.11 | 0.272556391 | 266 | 0.064 | 0.178 | 33.179 | 429 | 1.123 |
| CF154 | 2 | 25.355 | 15.00 | 0.333 | 3.56 | 1.374100719 | 64.82513089 | 0.161538462 | 130 | 0.139 | 0.215 | 34.956 | 451 | 1.169 |
| CF155 | 2 | 30.5 | 22.00 | 0.833 | 2.94 | 0.384422896 | 60.78551668 | 0.087227414 | 321 | 0.065 | 0.206 | 31.305 | 429 | 1.200 |
| CF11 | 3 | 29.6 | 19.00 | 0.667 | 2.94 | 0.359399437 | 57.77058312 | 0.221052632 | 95 | 0.126 | 0.232 | 38.387 | 438 | 1.109 |
| CF22 | 3 | 26.275 | 5.00 | 0.571 | 1.64 | 0.318423522 | 65.52848723 | 0.116336634 | 202 | 0.147 | 0.242 | 38.095 | 438 | 1.177 |
| CF27 | 3 | 26.76 | 13.75 | 1.000 | 3.83 | 0.168908352 | 71.90814815 | 0.351626016 | 246 | 0.130 | 0.227 | 35.930 | 433 | 1.169 |
| CF28 | 3 | NA | 0.00 | NA | 0.48 | NA | NA | NA | NA | NA | NA | NA | NA | 1.136 |
| CF32 | 3 | 30.225 | 12.75 | 0.714 | 2.31 | 0.343134188 | 58.04329991 | 0.197044335 | 203 | 0.161 | 0.232 | 35.163 | 440 | 1.175 |
| CF38 | 3 | 24.37 | 17.50 | 0.833 | 3.02 | 0.392555521 | 68.26199203 | 0 | 228 | 0.090 | 0.208 | 30.273 | 439 | 1.091 |
| CF41 | 3 | 30.235 | 4.50 | 0.667 | 1.49 | 0.356897091 | 59.4347064 | 0.834567901 | 202.5 | 0.182 | 0.283 | 33.130 | 440 | 1.153 |
| CF52 | 3 | 23.265 | 6.50 | 0.800 | 2.15 | 0.399124179 | 70.92946708 | 0.288922156 | 334 | 0.145 | 0.267 | 30.436 | 432 | 1.167 |
| CF76 | 3 | 24.97 | 12.00 | 0.500 | 1.88 | NA | NA | 0.216216216 | 185 | 0.198 | 0.269 | 36.831 | 451 | 1.134 |
| CF84 | 3 | 28.64 | 8.00 | 0.800 | 3.6 | 0.508914607 | 66.55408728 | 0.059753954 | 284.5 | 0.215 | 0.295 | 32.912 | 439 | 1.122 |
| CF95 | 3 | 17.01 | 2.00 | 0.000 | 0.57 | NA | NA | 0.953367876 | 193 | NA | NA | NA | NA | 1.106 |
| CF106 | 3 | 23.15 | 9.00 | 0.200 | 4.82 | 0.492649359 | 50.5968254 | 0.313333333 | 150 | 0.083 | 0.202 | 32.215 | 441 | 1.103 |
| CF121 | 3 | 19.59 | 3.00 | 0.000 | 0.92 | NA | NA | 0.082901554 | 193 | 0.177 | 0.193 | 39.940 | 453 | 1.063 |
| CF122 | 3 | NA | 1.75 | 0.000 | 0.68 | 0.100093838 | 62.94375 | NA | NA | 0.161 | 0.188 | 32.308 | 455 | NA |
| CF127 | 3 | 21.99 | 5.75 | 0.667 | 3.22 | 0.46574914 | 78.35352586 | 0.12371134 | 242.5 | 0.159 | 0.276 | 26.019 | 440 | 1.141 |
| CF137 | 3 | 28.49 | NA | 0.833 | 5 | NA | NA | 0.875 | 24 | 0.172 | 0.290 | 30.669 | 431 | 1.250 |
| CF149 | 3 | 25.26 | 8.00 | 0.667 | 2.71 | 0.222083203 | 88.04957746 | 0.227467811 | 233 | 0.083 | 0.235 | 31.737 | 429 | 1.178 |
| CF152 | 3 | 28.59 | 14.50 | 0.833 | 2.39 | 0.249296215 | NA | 0 | 395 | 0.130 | 0.299 | 29.039 | 432 | 1.200 |
| CF158 | 3 | 32.095 | 8.75 | 0.600 | 3.06 | 0.416953394 | 81.15378845 | 0.243386243 | 189 | 0.185 | 0.233 | 39.790 | 438 | 1.183 |
| CF8 | 4 | 32.635 | 14.00 | 0.833 | 2.69 | 0.434782609 | 71.68 | NA | NA | 0.097 | 0.255 | 34.786 | 438 | 1.194 |
| CF23 | 4 | 24.215 | 5.00 | 0.000 | 0.81 | 0.181420081 | 38.47724138 | 0 | 195 | 0.062 | 0.249 | 26.597 | 439 | 1.188 |
| CF30 | 4 | 22.57 | 9.75 | 0.833 | 2.74 | NA | NA | 1 | 6 | 0.173 | 0.310 | 31.342 | 434 | 1.394 |
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| **ID** | Plant Identification Number |
| **PollenColor** | Pollen Color score: 0=white, 1=tan, 2=light purple, 3=purple, 4=dark purple |
| **MeanFlwDiam** | Average Flower Diameter (mm) from 2 flowers |
| **MeanFlwNum** | Flower production per week. Number of flowers produced per week. |
| **Autonomy** | Proportion autonomous fruit set. Number of fruits divided by number of flowers |
| **Biomass** | Above-ground dry biomass (g) |
| **NectarVolume** | Nectar volume per flower (uL) |
| **NectarConc** | Nectar sugar concentration (%) |
| **PollenViab** | Pollen viability (dark aniline-blue stained grains / total grains counted) |
| **PollenProduction** | Number of pollen grains scored in 0.3 uL |
| BombusX | X coordinate of petal reflectance modeled in hexagonal color space using Bombus impatiens visual system |
| BombusY | Y coordinate of petal reflectance modeled in hexagonal color space using Bombus impatiens visual system |
| BlueBright | Peak reflectance of petals in the blue spectrum (~437nm) |
| BlueHue | Wavelength of the blue spectral peak. |
| MeanPollDiam | Average diameter of |

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| **Pollen Color** | **Delphinidin** | **Cyanidin** | **Peonidin** | **apigenin** | **luteolin** | **kaempferol** | **quercetin** | **myricetin** | **unknowns** | **Nonanthocyanin phenolics** |
| **0** | 0.001732098 | 3.56023E-04 | 0 | 0.061219367 | 0.149040824 | 0.071338195 | 0.07866788 | 0.351668085 | 0.264843339 | 0.97677769 |
| **1** | 0.003644719 | 0.001444557 | 2.28615E-05 | 0.106073556 | 0.620219779 | 0.217279916 | 0.07851826 | 0.363632256 | 0.189863708 | 1.575587475 |
| **2** | 0.001159181 | 0.005169527 | 6.98625E-05 | 0.035827248 | 0.12411194 | 0.118389725 | 0.069916066 | 0.304455446 | 0.159486109 | 0.812186534 |
| **3** | 0.001312461 | 0.014912866 | 1.16183E-04 | 0.040893401 | 0.125064788 | 0.154497741 | 0.107819214 | 0.274522887 | 0.16973674 | 0.872534772 |
| **4** | 0.002518695 | 0.008285158 | 1.45142E-04 | 0.066663838 | 0.518423441 | 0.094602439 | 0.010428479 | 0.263786415 | 0.102876933 | 1.056781546 |
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| HPLC results of flavones, flavonols, and anthocyanins in five color classes of Campanula americana pollen (in ug/mg) |  |  |  |  |  |  |  |  |  |  |
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| **MomID** | **PolCol** | **DadID** | **DadPolCol** | **DateBlock** | **Seeds** | **FlwPos** |  |  |
| 2 | W | 8 | P | 1 | 63 | 1 |  |  |
| 2 | W | 20 | W | 1 | 66 | 1 |  |  |
| 8 | P | 73 | W | 1 | 70 | 1 |  |  |
| 8 | P | 38 | P | 1 | 75 | 1 |  |  |
| 10 | W | 90 | P | 3 | 74 | 1 |  |  |
| 10 | W | 20 | W | 3 | 75 | 1 |  |  |
| 11 | P | 107 | W | 2 | 78 | 1 |  |  |
| 11 | P | 149 | P | 2 | 81 | 1 |  |  |
| 13 | W | 127 | P | 4 | 77 | 1 |  |  |
| 13 | W | 54 | W | 4 | 83 | 1 |  |  |
| 16 | W | 11 | P | 1 | 90 | 1 |  |  |
| 16 | W | 54 | W | 1 | 90 | 1 |  |  |
| 20 | W | 10 | W | 3 | 55 | 2 |  |  |
| 23 | P | 107 | W | 1 | 14 | 1 |  |  |
| 23 | P | 152 | P | 1 | 19 | 1 |  |  |
| 26 | W | 10 | W | 1 | 60 | 1 |  |  |
| 26 | W | 32 | P | 1 | 65 | 1 |  |  |
| 27 | P | 41 | P | 3 | 32 | 1 |  |  |
| 27 | P | 2 | W | 3 | 41 | 1 |  |  |
| 32 | W | 23 | P | 1 | 78 | 1 |  |  |
| 32 | W | 2 | W | 1 | 78 | 1 |  |  |
| 38 | P | 113 | W | 1 | 77 | 1 |  |  |
| 38 | P | 32 | P | 1 | 97 | 1 |  |  |
| 41 | P | 80 | W | 3 | 52 | 1 |  |  |
| 41 | P | 27 | P | 3 | 54 | 1 |  |  |
| 45 | W | 16 | W | 1 | 70 | 1 |  |  |
| 45 | W | 8 | P | 1 | 81 | 1 |  |  |
| 54 | W | 45 | W | 1 | 51 | 1 |  |  |
| 54 | W | 11 | P | 1 | 73 | 1 |  |  |
| 73 | W | 152 | P | 1 | 36 | 2 |  |  |
| 73 | W | 97 | W | 1 | 41 | 2 |  |  |
| 80 | W | 16 | W | 3 | 0 | 2 |  |  |
| 80 | W | 149 | P | 3 | 24 | 2 |  |  |
| 84 | P | 152 | P | 4 | 55 | 1 |  |  |
| 84 | P | 97 | W | 4 | 63 | 1 |  |  |
| 90 | P | 27 | P | 3 | 66 | 1 |  |  |
| 90 | P | 113 | W | 3 | 66 | 1 |  |  |
| 97 | W | 107 | W | 4 | 54 | 2 |  |  |
| 97 | W | 84 | P | 4 | 72 | 2 |  |  |
| 107 | W | 2 | W | 2 | 63 | 1 |  |  |
| 107 | W | 32 | P | 2 | 84 | 1 |  |  |
| 113 | W | 38 | P | 1 | 62 | 1 |  |  |
| 113 | W | 29 | W | 1 | 62 | 1 |  |  |
| 149 | P | 23 | P | 2 | 93 | 1 |  |  |
| 149 | P | 20 | W | 2 | 94 | 1 |  |  |
| 152 | P | 80 | W | 1 | 78 | 1 |  |  |
| 152 | P | 8 | P | 1 | 79 | 1 |  |  |
| 158 | P | 124 | P | 3 | 34 | 1 |  |  |
| 158 | P | 97 | W | 3 | 66 | 1 |  |  |

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| **MomID** | Maternal Plant ID |
| **PolCol** | Maternal Pollen color |
| **DadID** | Paternal plant ID |
| **DadPolCol** | paternal pollen color |
| **DateBlock** | date of pollination |
| **Seeds** | Seedsa produced |
| **FlwPos** | Flower position on infloresence (1=primary; 2=secondary) |

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| **ID** | **Cross** | **Mom** | **Dad** | **MomCol** | **DadCol** | **Planted** | **Germ318** | **Germ320** | **Germ322** | **Germ325** | **Germ327** | **Germ329** | **Prop318** | **Prop320** | **Prop322** | **Prop325** | **Prop327** | **Prop329** | **Survival** | **LeafNum\_4.27** | **LfWidth\_4.27** | **VegSize** | **Fitness** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 113x38.2 | 113 | 38 | W | P | 5 | 0 | 3 | 4 | 5 | 5 | 5 | 0 | 0.6 | 0.8 | 1 | 1 | 1 | 1 | 6 | 10.7 | 64.2 | 64.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2 | 23x107.1 | 23 | 107 | P | W | 5 | 0 | 1 | 3 | 4 | 4 | 4 | 0 | 0.2 | 0.6 | 0.8 | 0.8 | 0.8 | 1 | 2 | 6.79 | 13.58 | 10.864 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3 | 149x23.3 | 149 | 23 | P | P | 5 | 0 | 2 | 4 | 5 | 5 | 5 | 0 | 0.4 | 0.8 | 1 | 1 | 1 | 0 | . | . | . | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4 | 41x80.2 | 41 | 80 | P | W | 5 | 0 | 1 | 2 | 5 | 5 | 5 | 0 | 0.2 | 0.4 | 1 | 1 | 1 | 1 | 4 | 9.14 | 36.56 | 36.56 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5 | 32x2.1 | 32 | 2 | W | W | 5 | 1 | 5 | 5 | 5 | 5 | 5 | 0.2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 8.91 | 17.82 | 17.82 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6 | 90x113.3 | 90 | 113 | P | W | 5 | 0 | 2 | 5 | 5 | 5 | 5 | 0 | 0.4 | 1 | 1 | 1 | 1 | 1 | 4 | 10.7 | 42.8 | 42.8 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7 | 8x73.1 | 8 | 73 | P | W | 5 | 0 | 1 | 4 | 5 | 5 | 5 | 0 | 0.2 | 0.8 | 1 | 1 | 1 | 1 | 2 | 7.4 | 14.8 | 14.8 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8 | 90x113.2 | 90 | 113 | P | W | 5 | 0 | 2 | 4 | 5 | 5 | 5 | 0 | 0.4 | 0.8 | 1 | 1 | 1 | 1 | 5 | 11.79 | 58.95 | 58.95 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 9 | 97x84.1 | 97 | 84 | W | P | 5 | 0 | 2 | 5 | 5 | 5 | 5 | 0 | 0.4 | 1 | 1 | 1 | 1 | 1 | 5 | 9.79 | 48.95 | 48.95 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10 | 113x29.3 | 113 | 29 | W | W | 5 | 0 | 1 | 3 | 5 | 4 | 4 | 0 | 0.2 | 0.6 | 1 | 0.8 | 0.8 | 1 | 5 | 9.53 | 47.65 | 38.12 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 11 | 20x10.2 | 20 | 10 | W | W | 5 | 0 | 0 | 3 | 4 | 4 | 4 | 0 | 0 | 0.6 | 0.8 | 0.8 | 0.8 | 0 | . | . | . | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 12 | 107x2.1 | 107 | 2 | W | W | 5 | 0 | 1 | 4 | 5 | 5 | 5 | 0 | 0.2 | 0.8 | 1 | 1 | 1 | 1 | 4 | 9.89 | 39.56 | 39.56 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 13 | 27x2.2 | 27 | 2 | P | W | 5 | 0 | 0 | 1 | 2 | 4 | 5 | 0 | 0 | 0.2 | 0.4 | 0.8 | 1 | 1 | 5 | 9.16 | 45.8 | 45.8 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 14 | 152x80.2 | 152 | 80 | P | W | 5 | 0 | 4 | 5 | 5 | 5 | 5 | 0 | 0.8 | 1 | 1 | 1 | 1 | 1 | 5 | 9.77 | 48.85 | 48.85 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 15 | 11x107.3 | 11 | 107 | P | W | 5 | 0 | 1 | 3 | 5 | 5 | 5 | 0 | 0.2 | 0.6 | 1 | 1 | 1 | 1 | 4 | 7.26 | 29.04 | 29.04 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 16 | 45x8.1 | 45 | 8 | W | P | 5 | 0 | 4 | 5 | 5 | 5 | 5 | 0 | 0.8 | 1 | 1 | 1 | 1 | 1 | 4 | 7.66 | 30.64 | 30.64 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 17 | 38x113.1 | 38 | 113 | P | W | 5 | 0 | 2 | 3 | 5 | 5 | 5 | 0 | 0.4 | 0.6 | 1 | 1 | 1 | 1 | 4 | 8.1 | 32.4 | 32.4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 18 | 38x32.2 | 38 | 32 | P | P | 5 | 0 | 2 | 3 | 5 | 5 | 5 | 0 | 0.4 | 0.6 | 1 | 1 | 1 | 1 | 3 | 8.54 | 25.62 | 25.62 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 19 | 32x23.2 | 32 | 23 | W | P | 5 | 0 | 3 | 4 | 5 | 5 | 5 | 0 | 0.6 | 0.8 | 1 | 1 | 1 | 1 | 4 | 9.19 | 36.76 | 36.76 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20 | 41x80.3 | 41 | 80 | P | W | 5 | 0 | 0 | 3 | 5 | 5 | 5 | 0 | 0 | 0.6 | 1 | 1 | 1 | 1 | 3 | 7.93 | 23.79 | 23.79 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 21 | 13x54.2 | 13 | 54 | W | W | 5 | 0 | 0 | 3 | 5 | 5 | 5 | 0 | 0 | 0.6 | 1 | 1 | 1 | 1 | 4 | 7.4 | 29.6 | 29.6 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 22 | 80x149.1 | 80 | 149 | W | P | 5 | 0 | 1 | 4 | 5 | 5 | 5 | 0 | 0.2 | 0.8 | 1 | 1 | 1 | 1 | 4 | 9.23 | 36.92 | 36.92 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 23 | 8x38.3 | 8 | 38 | P | P | 5 | 3 | 4 | 4 | 5 | 5 | 5 | 0.6 | 0.8 | 0.8 | 1 | 1 | 1 | 1 | 2 | 9.74 | 19.48 | 19.48 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 24 | 73x152.2 | 73 | 152 | W | P | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 4.84 | 9.68 | 9.68 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 25 | 27x41.1 | 27 | 41 | P | P | 5 | 0 | 1 | 4 | 4 | 5 | 5 | 0 | 0.2 | 0.8 | 0.8 | 1 | 1 | 1 | 3 | 8.8 | 26.4 | 26.4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 26 | 38x32.1 | 38 | 32 | P | P | 5 | 0 | 1 | 5 | 5 | 5 | 5 | 0 | 0.2 | 1 | 1 | 1 | 1 | 1 | 3 | 11.44 | 34.32 | 34.32 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 27 | 16x11.2 | 16 | 11 | W | P | 5 | 0 | 1 | 3 | 5 | 5 | 5 | 0 | 0.2 | 0.6 | 1 | 1 | 1 | 1 | 4 | 6.46 | 25.84 | 25.84 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 28 | 107x32.2 | 107 | 32 | W | P | 5 | 0 | 0 | 5 | 5 | 5 | 5 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 4 | 7.87 | 31.48 | 31.48 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 29 | 107x32.1 | 107 | 32 | W | P | 5 | 0 | 1 | 5 | 5 | 5 | 5 | 0 | 0.2 | 1 | 1 | 1 | 1 | 1 | 4 | 9.8 | 39.2 | 39.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30 | 80x149.2 | 80 | 149 | W | P | 5 | 0 | 2 | 4 | 5 | 5 | 5 | 0 | 0.4 | 0.8 | 1 | 1 | 1 | 1 | 3 | 10.27 | 30.81 | 30.81 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 31 | 41x27.1 | 41 | 27 | P | P | 5 | 0 | 3 | 4 | 5 | 5 | 5 | 0 | 0.6 | 0.8 | 1 | 1 | 1 | 1 | 1 | 5.43 | 5.43 | 5.43 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 32 | 26x32.2 | 26 | 32 | W | P | 5 | 2 | 5 | 5 | 5 | 5 | 5 | 0.4 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 11.77 | 82.39 | 82.39 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 33 | 2x8.3 | 2 | 8 | W | P | 5 | 0 | 1 | 4 | 4 | 4 | 4 | 0 | 0.2 | 0.8 | 0.8 | 0.8 | 0.8 | 1 | 4 | 9.81 | 39.24 | 31.392 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 34 | 2x8.1 | 2 | 8 | W | P | 5 | 0 | 0 | 4 | 5 | 5 | 5 | 0 | 0 | 0.8 | 1 | 1 | 1 | 1 | 5 | 11.61 | 58.05 | 58.05 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 35 | 10x20.1 | 10 | 20 | W | W | 5 | 0 | 1 | 4 | 5 | 5 | 5 | 0 | 0.2 | 0.8 | 1 | 1 | 1 | 1 | 5 | 10.61 | 53.05 | 53.05 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 36 | 54x11.3 | 54 | 11 | W | P | 5 | 0 | 0 | 3 | 5 | 5 | 5 | 0 | 0 | 0.6 | 1 | 1 | 1 | 1 | 4 | 9.3 | 37.2 | 37.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 37 | 26x10.1 | 26 | 10 | W | W | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 6.6 | 13.2 | 13.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 38 | 73x97.1 | 73 | 97 | W | W | 5 | 2 | 4 | 5 | 5 | 5 | 5 | 0.4 | 0.8 | 1 | 1 | 1 | 1 | 1 | 6 | 10.28 | 61.68 | 61.68 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 39 | 27x2.3 | 27 | 2 | P | W | 5 | 0 | 1 | 2 | 3 | 4 | 4 | 0 | 0.2 | 0.4 | 0.6 | 0.8 | 0.8 | 1 | 5 | 9.92 | 49.6 | 39.68 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40 | 113x29.1 | 113 | 29 | W | W | 5 | 0 | 3 | 3 | 3 | 4 | 4 | 0 | 0.6 | 0.6 | 0.6 | 0.8 | 0.8 | 1 | 5 | 10.32 | 51.6 | 41.28 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 41 | 26x10.3 | 26 | 10 | W | W | 5 | 0 | 4 | 5 | 5 | 5 | 5 | 0 | 0.8 | 1 | 1 | 1 | 1 | 1 | 4 | 9.74 | 38.96 | 38.96 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 42 | 107x2.3 | 107 | 2 | W | W | 5 | 0 | 0 | 2 | 5 | 5 | 5 | 0 | 0 | 0.4 | 1 | 1 | 1 | 1 | 4 | 10.74 | 42.96 | 42.96 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 43 | 107x32.3 | 107 | 32 | W | P | 5 | 0 | 0 | 5 | 5 | 5 | 5 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 4 | 8.2 | 32.8 | 32.8 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 44 | 73x97.3 | 73 | 97 | W | W | 4 | 0 | 4 | 4 | 4 | 4 | 4 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 5 | 9.41 | 47.05 | 47.05 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 45 | 23x107.3 | 23 | 107 | P | W | 5 | 0 | 0 | 3 | 4 | 4 | 4 | 0 | 0 | 0.6 | 0.8 | 0.8 | 0.8 | 1 | 4 | 10.82 | 43.28 | 34.624 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 46 | 90x113.1 | 90 | 113 | P | W | 5 | 0 | 3 | 5 | 5 | 5 | 5 | 0 | 0.6 | 1 | 1 | 1 | 1 | 1 | 4 | 11.87 | 47.48 | 47.48 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 47 | 23x152.2 | 23 | 152 | P | P | 5 | 0 | 3 | 3 | 3 | 3 | 3 | 0 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 1 | 7 | 14.45 | 101.15 | 60.69 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 48 | 84x152.3 | 84 | 152 | P | P | 5 | 0 | 0 | 5 | 5 | 5 | 5 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 4 | 10.19 | 40.76 | 40.76 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 49 | 10x20.2 | 10 | 20 | W | W | 5 | 0 | 0 | 3 | 3 | 4 | 5 | 0 | 0 | 0.6 | 0.6 | 0.8 | 1 | 1 | 4 | 9.12 | 36.48 | 36.48 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 50 | 73x152.1 | 73 | 152 | W | P | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 4 | 10.05 | 40.2 | 40.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 51 | 45x16.1 | 45 | 16 | W | W | 5 | 0 | 4 | 5 | 5 | 5 | 5 | 0 | 0.8 | 1 | 1 | 1 | 1 | 1 | 4 | 9.56 | 38.24 | 38.24 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 52 | 26x32.1 | 26 | 32 | W | P | 5 | 0 | 5 | 5 | 5 | 5 | 5 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 5 | 9.94 | 49.7 | 49.7 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 53 | 23x152.1 | 23 | 152 | P | P | 5 | 1 | 5 | 5 | 5 | 5 | 5 | 0.2 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 11.81 | 35.43 | 35.43 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 54 | 158x124.2 | 158 | 124 | P | P | 5 | 0 | 1 | 3 | 4 | 4 | 4 | 0 | 0.2 | 0.6 | 0.8 | 0.8 | 0.8 | 0 | . | . | . | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 55 | 152x8.1 | 152 | 8 | P | P | 5 | 0 | 2 | 5 | 5 | 5 | 5 | 0 | 0.4 | 1 | 1 | 1 | 1 | 1 | 4 | 9.74 | 38.96 | 38.96 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 56 | 54x45.2 | 54 | 45 | W | W | 5 | 0 | 0 | 2 | 3 | 4 | 4 | 0 | 0 | 0.4 | 0.6 | 0.8 | 0.8 | 1 | 3 | 6.69 | 20.07 | 16.056 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 57 | 80x149.3 | 80 | 149 | W | P | 5 | 0 | 2 | 2 | 4 | 4 | 4 | 0 | 0.4 | 0.4 | 0.8 | 0.8 | 0.8 | 1 | 1 | 8.84 | 8.84 | 7.072 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 58 | 84x152.1 | 84 | 152 | P | P | 5 | 0 | 0 | 5 | 5 | 5 | 5 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 3 | 6.8 | 20.4 | 20.4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 59 | 38x32.3 | 38 | 32 | P | P | 5 | 0 | 0 | 4 | 4 | 5 | 5 | 0 | 0 | 0.8 | 0.8 | 1 | 1 | 1 | 5 | 11.11 | 55.55 | 55.55 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 60 | 90x27.1 | 90 | 27 | P | P | 5 | 0 | 0 | 0 | 3 | 5 | 5 | 0 | 0 | 0 | 0.6 | 1 | 1 | 1 | 4 | 11.28 | 45.12 | 45.12 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 61 | 45x8.2 | 45 | 8 | W | P | 5 | 0 | 1 | 3 | 5 | 5 | 5 | 0 | 0.2 | 0.6 | 1 | 1 | 1 | 1 | 4 | 11.95 | 47.8 | 47.8 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 62 | 23x107.2 | 23 | 107 | P | W | 3 | 0 | 3 | 3 | 3 | 3 | 3 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 4 | 8.31 | 33.24 | 33.24 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 63 | 158x97.1 | 158 | 97 | P | W | 5 | 0 | 0 | 3 | 4 | 5 | 5 | 0 | 0 | 0.6 | 0.8 | 1 | 1 | 1 | 1 | 3.77 | 3.77 | 3.77 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 64 | 149x20.2 | 149 | 20 | P | W | 5 | 0 | 1 | 4 | 4 | 5 | 5 | 0 | 0.2 | 0.8 | 0.8 | 1 | 1 | 1 | 4 | 10.33 | 41.32 | 41.32 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 65 | 54x45.1 | 54 | 45 | W | W | 5 | 0 | 1 | 2 | 5 | 5 | 5 | 0 | 0.2 | 0.4 | 1 | 1 | 1 | 1 | 3 | 10.4 | 31.2 | 31.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 66 | 16x11.3 | 16 | 11 | W | P | 5 | 0 | 1 | 4 | 5 | 5 | 5 | 0 | 0.2 | 0.8 | 1 | 1 | 1 | 1 | 4 | 9.22 | 36.88 | 36.88 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 67 | 90x27.2 | 90 | 27 | P | P | 5 | 0 | 0 | 3 | 5 | 5 | 5 | 0 | 0 | 0.6 | 1 | 1 | 1 | 1 | 3 | 9.3 | 27.9 | 27.9 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 68 | 84x97.1 | 84 | 97 | P | W | 5 | 0 | 0 | 0 | 2 | 3 | 3 | 0 | 0 | 0 | 0.4 | 0.6 | 0.6 | 1 | 5 | 10.77 | 53.85 | 32.31 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 69 | 113x29.2 | 113 | 29 | W | W | 5 | 0 | 3 | 3 | 4 | 5 | 5 | 0 | 0.6 | 0.6 | 0.8 | 1 | 1 | 1 | 5 | 8.95 | 44.75 | 44.75 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 70 | 45x8.3 | 45 | 8 | W | P | 5 | 0 | 1 | 5 | 5 | 5 | 5 | 0 | 0.2 | 1 | 1 | 1 | 1 | 1 | 5 | 11.03 | 55.15 | 55.15 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 71 | 73x152.3 | 73 | 152 | W | P | 5 | 2 | 5 | 5 | 5 | 5 | 5 | 0.4 | 1 | 1 | 1 | 1 | 1 | 1 | 4 | 11.1 | 44.4 | 44.4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 72 | 113x38.3 | 113 | 38 | W | P | 5 | 0 | 3 | 4 | 5 | 5 | 5 | 0 | 0.6 | 0.8 | 1 | 1 | 1 | 1 | 5 | 8.17 | 40.85 | 40.85 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 73 | 8x73.2 | 8 | 73 | P | W | 5 | 0 | 0 | 0 | 1 | 4 | 5 | 0 | 0 | 0 | 0.2 | 0.8 | 1 | 1 | 2 | 7.66 | 15.32 | 15.32 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 74 | 27x41.3 | 27 | 41 | P | P | 5 | 0 | 0 | 0 | 3 | 3 | 4 | 0 | 0 | 0 | 0.6 | 0.6 | 0.8 | 1 | 4 | 11.84 | 47.36 | 37.888 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 75 | 45x16.3 | 45 | 16 | W | W | 5 | 1 | 4 | 5 | 5 | 5 | 5 | 0.2 | 0.8 | 1 | 1 | 1 | 1 | 1 | 6 | 10.21 | 61.26 | 61.26 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 76 | 54x11.1 | 54 | 11 | W | P | 5 | 0 | 1 | 4 | 5 | 5 | 5 | 0 | 0.2 | 0.8 | 1 | 1 | 1 | 1 | 4 | 10.61 | 42.44 | 42.44 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 77 | 97x107.1 | 97 | 107 | W | W | 5 | 0 | 0 | 2 | 5 | 5 | 5 | 0 | 0 | 0.4 | 1 | 1 | 1 | 1 | 4 | 10.95 | 43.8 | 43.8 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 78 | 13x54.3 | 13 | 54 | W | W | 5 | 0 | 0 | 0 | 4 | 5 | 5 | 0 | 0 | 0 | 0.8 | 1 | 1 | 1 | 4 | 7.88 | 31.52 | 31.52 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 79 | 84x97.3 | 84 | 97 | P | W | 5 | 0 | 1 | 3 | 5 | 5 | 5 | 0 | 0.2 | 0.6 | 1 | 1 | 1 | 1 | 4 | 8.66 | 34.64 | 34.64 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 80 | 2x2.3 | 2 | 20 | W | W | 5 | 0 | 0 | 4 | 5 | 5 | 5 | 0 | 0 | 0.8 | 1 | 1 | 1 | 1 | 4 | 9.81 | 39.24 | 39.24 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 81 | 84x152.2 | 84 | 152 | P | P | 5 | 0 | 1 | 5 | 5 | 5 | 5 | 0 | 0.2 | 1 | 1 | 1 | 1 | 1 | 4 | 9.46 | 37.84 | 37.84 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 82 | 32x2.2 | 32 | 2 | W | W | 5 | 0 | 3 | 4 | 5 | 5 | 5 | 0 | 0.6 | 0.8 | 1 | 1 | 1 | 1 | 5 | 10.22 | 51.1 | 51.1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 83 | 149x23.2 | 149 | 23 | P | P | 5 | 0 | 0 | 2 | 4 | 5 | 5 | 0 | 0 | 0.4 | 0.8 | 1 | 1 | 1 | 3 | 7.94 | 23.82 | 23.82 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 84 | 13x127.2 | 13 | 127 | W | P | 5 | 0 | 0 | 3 | 5 | 5 | 5 | 0 | 0 | 0.6 | 1 | 1 | 1 | 1 | 4 | 8.91 | 35.64 | 35.64 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 85 | 26x32.3 | 26 | 32 | W | P | 5 | 1 | 3 | 5 | 5 | 5 | 5 | 0.2 | 0.6 | 1 | 1 | 1 | 1 | 1 | 3 | 9.48 | 28.44 | 28.44 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 86 | 16x54.1 | 16 | 54 | W | W | 5 | 0 | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 0 | 0.4 | 0.4 | 0.4 | 1 | 5 | 12.39 | 61.95 | 24.78 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 87 | 11x149.2 | 11 | 149 | P | P | 5 | 0 | 0 | 1 | 4 | 4 | 5 | 0 | 0 | 0.2 | 0.8 | 0.8 | 1 | 1 | 4 | 10.9 | 43.6 | 43.6 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 88 | 2x8.2 | 2 | 8 | W | P | 5 | 0 | 1 | 3 | 3 | 4 | 4 | 0 | 0.2 | 0.6 | 0.6 | 0.8 | 0.8 | 1 | 3 | 9.48 | 28.44 | 22.752 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 89 | 149x20.3 | 149 | 20 | P | W | 5 | 0 | 0 | 3 | 5 | 5 | 5 | 0 | 0 | 0.6 | 1 | 1 | 1 | 1 | 4 | 9.67 | 38.68 | 38.68 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 90 | 27x41.2 | 27 | 41 | P | P | 5 | 0 | 0 | 0 | 4 | 4 | 5 | 0 | 0 | 0 | 0.8 | 0.8 | 1 | 0 | . | . | . | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 91 | 41x80.1 | 41 | 80 | P | W | 5 | 0 | 0 | 0 | 4 | 4 | 4 | 0 | 0 | 0 | 0.8 | 0.8 | 0.8 | 1 | 3 | 9.56 | 28.68 | 22.944 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 92 | 152x80.1 | 152 | 80 | P | W | 5 | 0 | 4 | 5 | 5 | 5 | 5 | 0 | 0.8 | 1 | 1 | 1 | 1 | 1 | 1 | 9.58 | 9.58 | 9.58 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 93 | 45x16.2 | 45 | 16 | W | W | 5 | 0 | 1 | 5 | 5 | 5 | 5 | 0 | 0.2 | 1 | 1 | 1 | 1 | 1 | 5 | 8.61 | 43.05 | 43.05 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 94 | 84x97.2 | 84 | 97 | P | W | 5 | 0 | 0 | 2 | 4 | 4 | 4 | 0 | 0 | 0.4 | 0.8 | 0.8 | 0.8 | 1 | 3 | 7.81 | 23.43 | 18.744 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 95 | 16x11.1 | 16 | 11 | W | P | 5 | 0 | 1 | 2 | 4 | 5 | 5 | 0 | 0.2 | 0.4 | 0.8 | 1 | 1 | 1 | 6 | 13.1 | 78.6 | 78.6 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 96 | 158x97.3 | 158 | 97 | P | W | 5 | 0 | 0 | 2 | 4 | 5 | 5 | 0 | 0 | 0.4 | 0.8 | 1 | 1 | 1 | 3 | 7.43 | 22.29 | 22.29 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 97 | 2x20.1 | 2 | 20 | W | W | 5 | 0 | 0 | 0 | 3 | 3 | 4 | 0 | 0 | 0 | 0.6 | 0.6 | 0.8 | 1 | 5 | 13.09 | 65.45 | 52.36 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 98 | 152x80.3 | 152 | 80 | P | W | 5 | 0 | 0 | 4 | 5 | 5 | 5 | 0 | 0 | 0.8 | 1 | 1 | 1 | 1 | 4 | 10.26 | 41.04 | 41.04 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 99 | 113x38.1 | 113 | 38 | W | P | 5 | 1 | 5 | 5 | 5 | 5 | 5 | 0.2 | 1 | 1 | 1 | 1 | 1 | 0 | . | . | . | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 100 | 11x107.1 | 11 | 107 | P | W | 5 | 0 | 2 | 2 | 4 | 5 | 5 | 0 | 0.4 | 0.4 | 0.8 | 1 | 1 | 1 | 5 | 9.15 | 45.75 | 45.75 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 101 | 13x127.1 | 13 | 127 | W | P | 5 | 0 | 0 | 1 | 5 | 5 | 5 | 0 | 0 | 0.2 | 1 | 1 | 1 | 1 | 2 | 10.98 | 21.96 | 21.96 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 102 | 11x149.1 | 11 | 149 | P | P | 5 | 0 | 0 | 4 | 5 | 5 | 5 | 0 | 0 | 0.8 | 1 | 1 | 1 | 1 | 2 | 7.88 | 15.76 | 15.76 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 103 | 32x23.3 | 32 | 23 | W | P | 5 | 0 | 2 | 4 | 5 | 5 | 5 | 0 | 0.4 | 0.8 | 1 | 1 | 1 | 1 | 6 | 13.42 | 80.52 | 80.52 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 104 | 2x20.2 | 2 | 20 | W | W | 5 | 0 | 0 | 5 | 5 | 5 | 5 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 4 | 10.18 | 40.72 | 40.72 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 105 | 90x27.3 | 90 | 27 | P | P | 5 | 0 | 0 | 2 | 3 | 4 | 4 | 0 | 0 | 0.4 | 0.6 | 0.8 | 0.8 | 1 | 1 | 1.83 | 1.83 | 1.464 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 106 | 13x127.3 | 13 | 127 | W | P | 5 | 0 | 0 | 3 | 5 | 5 | 5 | 0 | 0 | 0.6 | 1 | 1 | 1 | 1 | 3 | 8.2 | 24.6 | 24.6 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 107 | 41x27.2 | 41 | 27 | P | P | 5 | 0 | 3 | 4 | 5 | 5 | 5 | 0 | 0.6 | 0.8 | 1 | 1 | 1 | 1 | 2 | 5.16 | 10.32 | 10.32 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 108 | 23x152.3 | 23 | 152 | P | P | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 0.5 | 1 | 1 | 1 | 1 | 1 | 1 | 7 | 13.35 | 93.45 | 93.45 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 109 | 152x8.3 | 152 | 8 | P | P | 5 | 0 | 1 | 3 | 5 | 5 | 5 | 0 | 0.2 | 0.6 | 1 | 1 | 1 | 1 | 4 | 10.03 | 40.12 | 40.12 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 110 | 97x84.3 | 97 | 84 | W | P | 5 | 0 | 1 | 3 | 5 | 5 | 5 | 0 | 0.2 | 0.6 | 1 | 1 | 1 | 1 | 3 | 5.84 | 17.52 | 17.52 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 111 | 10x90.3 | 10 | 90 | W | P | 5 | 0 | 2 | 4 | 5 | 5 | 5 | 0 | 0.4 | 0.8 | 1 | 1 | 1 | 1 | 1 | 5.26 | 5.26 | 5.26 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 113 | 10x90.2 | 10 | 90 | W | P | 5 | 0 | 1 | 5 | 5 | 5 | 5 | 0 | 0.2 | 1 | 1 | 1 | 1 | 0 | . | . | . | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 114 | 8x38.2 | 8 | 38 | P | P | 5 | 0 | 4 | 5 | 5 | 5 | 5 | 0 | 0.8 | 1 | 1 | 1 | 1 | 1 | 4 | 8.97 | 35.88 | 35.88 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 115 | 13x54.1 | 13 | 54 | W | W | 5 | 0 | 0 | 2 | 5 | 4 | 4 | 0 | 0 | 0.4 | 1 | 0.8 | 0.8 | 1 | 4 | 8.99 | 35.96 | 28.768 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 116 | 8x73.3 | 8 | 73 | P | W | 5 | 0 | 0 | 1 | 3 | 3 | 4 | 0 | 0 | 0.2 | 0.6 | 0.6 | 0.8 | 1 | 3 | 9.43 | 28.29 | 22.632 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 117 | 158x97.2 | 158 | 97 | P | W | 5 | 0 | 1 | 1 | 3 | 5 | 5 | 0 | 0.2 | 0.2 | 0.6 | 1 | 1 | 1 | 4 | 12.02 | 48.08 | 48.08 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 118 | 97x84.2 | 97 | 84 | W | P | 5 | 0 | 1 | 5 | 5 | 5 | 5 | 0 | 0.2 | 1 | 1 | 1 | 1 | 1 | 1 | 9.44 | 9.44 | 9.44 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 119 | 8x38.1 | 8 | 38 | P | P | 5 | 0 | 4 | 5 | 5 | 5 | 5 | 0 | 0.8 | 1 | 1 | 1 | 1 | 1 | 3 | 9.79 | 29.37 | 29.37 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 120 | 20x10.1 | 20 | 10 | W | W | 5 | 0 | 0 | 1 | 4 | 4 | 4 | 0 | 0 | 0.2 | 0.8 | 0.8 | 0.8 | 1 | 4 | 10.94 | 43.76 | 35.008 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 121 | 10x90.1 | 10 | 90 | W | P | 5 | 0 | 3 | 5 | 5 | 5 | 5 | 0 | 0.6 | 1 | 1 | 1 | 1 | 1 | 4 | 8.24 | 32.96 | 32.96 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 122 | 10x20.3 | 10 | 20 | W | W | 5 | 0 | 0 | 3 | 5 | 5 | 5 | 0 | 0 | 0.6 | 1 | 1 | 1 | 1 | 4 | 12.5 | 50 | 50 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 123 | 16x54.3 | 16 | 54 | W | W | 5 | 0 | 0 | 3 | 4 | 4 | 4 | 0 | 0 | 0.6 | 0.8 | 0.8 | 0.8 | 1 | 4 | 10.73 | 42.92 | 34.336 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 124 | 97x107.2 | 97 | 107 | W | W | 5 | 0 | 0 | 0 | 4 | 4 | 4 | 0 | 0 | 0 | 0.8 | 0.8 | 0.8 | 1 | 4 | 9.9 | 39.6 | 31.68 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 125 | 54x45.3 | 54 | 45 | W | W | 5 | 0 | 0 | 2 | 4 | 5 | 5 | 0 | 0 | 0.4 | 0.8 | 1 | 1 | 1 | 4 | 9.37 | 37.48 | 37.48 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 126 | 158x124.1 | 158 | 124 | P | P | 5 | 0 | 0 | 4 | 5 | 5 | 5 | 0 | 0 | 0.8 | 1 | 1 | 1 | 0 | . | . | . | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 127 | 54x11.2 | 54 | 11 | W | P | 5 | 0 | 0 | 3 | 4 | 5 | 5 | 0 | 0 | 0.6 | 0.8 | 1 | 1 | 0 | . | . | . | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 128 | 26x10.2 | 26 | 10 | W | W | 5 | 0 | 2 | 3 | 4 | 4 | 4 | 0 | 0.4 | 0.6 | 0.8 | 0.8 | 0.8 | 1 | 5 | 9.29 | 46.45 | 37.16 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 129 | 11x107.2 | 11 | 107 | P | W | 5 | 0 | 0 | 1 | 4 | 5 | 5 | 0 | 0 | 0.2 | 0.8 | 1 | 1 | 1 | 4 | 8.39 | 33.56 | 33.56 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 130 | 152x8.2 | 152 | 8 | P | P | 5 | 0 | 3 | 3 | 5 | 5 | 5 | 0 | 0.6 | 0.6 | 1 | 1 | 1 | 1 | 4 | 10.02 | 40.08 | 40.08 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 131 | 97x107.3 | 97 | 107 | W | W | 5 | 0 | 1 | 2 | 5 | 5 | 5 | 0 | 0.2 | 0.4 | 1 | 1 | 1 | 1 | 2 | 7.15 | 14.3 | 14.3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 132 | 16x54.2 | 16 | 54 | W | W | 5 | 0 | 0 | 3 | 5 | 5 | 5 | 0 | 0 | 0.6 | 1 | 1 | 1 | 1 | 4 | 8.8 | 35.2 | 35.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 133 | 107x2.2 | 107 | 2 | W | W | 5 | 0 | 1 | 3 | 5 | 5 | 5 | 0 | 0.2 | 0.6 | 1 | 1 | 1 | 1 | 1 | 7.68 | 7.68 | 7.68 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 134 | 27x2.1 | 27 | 2 | P | W | 5 | 0 | 0 | 2 | 5 | 5 | 5 | 0 | 0 | 0.4 | 1 | 1 | 1 | 1 | 4 | 8.27 | 33.08 | 33.08 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 135 | 41x27.3 | 41 | 27 | P | P | 5 | 0 | 1 | 3 | 5 | 4 | 4 | 0 | 0.2 | 0.6 | 1 | 0.8 | 0.8 | 1 | 6 | 11.5 | 69 | 55.2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 136 | 38x113.3 | 38 | 113 | P | W | 5 | 0 | 1 | 4 | 5 | 5 | 5 | 0 | 0.2 | 0.8 | 1 | 1 | 1 | 1 | 5 | 10.72 | 53.6 | 53.6 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 137 | 38x113.2 | 38 | 113 | P | W | 5 | 1 | 1 | 5 | 5 | 5 | 5 | 0.2 | 0.2 | 1 | 1 | 1 | 1 | 1 | 7 | 13.11 | 91.77 | 91.77 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 138 | 32x23.1 | 32 | 23 | W | P | 5 | 1 | 3 | 5 | 5 | 5 | 5 | 0.2 | 0.6 | 1 | 1 | 1 | 1 | 1 | 2 | 7.55 | 15.1 | 15.1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 139 | 32x2.3 | 32 | 2 | W | W | 5 | 0 | 2 | 4 | 5 | 5 | 5 | 0 | 0.4 | 0.8 | 1 | 1 | 1 | 1 | 8 | 11.54 | 92.32 | 92.32 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 140 | 149x23.1 | 149 | 23 | P | P | 5 | 0 | 1 | 3 | 5 | 5 | 5 | 0 | 0.2 | 0.6 | 1 | 1 | 1 | 1 | 3 | 8.07 | 24.21 | 24.21 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 141 | 149x20.1 | 149 | 20 | P | W | 5 | 0 | 4 | 5 | 5 | 5 | 5 | 0 | 0.8 | 1 | 1 | 1 | 1 | 1 | 4 | 10.33 | 41.32 | 41.32 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 142 | 20x10.3 | 20 | 10 | W | W | 5 | 0 | 1 | 4 | 5 | 5 | 5 | 0 | 0.2 | 0.8 | 1 | 1 | 1 | 1 | 2 | 8.54 | 17.08 | 17.08 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 143 | 158x124.3 | 158 | 124 | P | P | 5 | 0 | 3 | 5 | 5 | 5 | 5 | 0 | 0.6 | 1 | 1 | 1 | 1 | 0 | . | . | . | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 144 | 11x149.3 | 11 | 149 | P | P | 5 | 0 | 2 | 4 | 5 | 5 | 5 | 0 | 0.4 | 0.8 | 1 | 1 | 1 | 1 | 5 | 10.81 | 54.05 | 54.05 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

|  |  |
| --- | --- |
| **ID** | Plant ID |
| **Cross** | Cross ID (maternal ID x paternal ID) |
| **Mom** | Maternal ID |
| **Dad** | Paternal ID |
| **MomCol** | Maternal Pollen color |
| **DadCol** | Paternal pollen color |
| **Planted** | Number of seeds planted |
| **Germ318** | Germination in cell on Mar 18 |
| **Germ320** | Germination in cell on Mar 20 |
| **Germ322** | Germination in cell on Mar 22 |
| **Germ325** | Germination in cell on Mar 25 |
| **Germ327** | Germination in cell on Mar 27 |
| **Germ329** | Germination in cell on Mar 29 |
| **Prop318** | Proportion Germinated on Mar 18 |
| **Prop320** | Proportion Germinated on Mar 20 |
| **Prop322** | Proportion Germinated on Mar 22 |
| **Prop325** | Proportion Germinated on Mar 25 |
| **Prop327** | Proportion Germinated on Mar 27 |
| **Prop329** | Proportion Germinated on Mar 29 |
| **Survival** | 1= plant survived 7 weeks after planting; 0= plant dead 7 weeks after planting |
| **LeafNum\_4.27** | Number of true leaves on April 27 |
| **LfWidth\_4.27** | Width of largest true leaf on April 27 |
| **VegSize** | LeafNum x Leaf Width |
| **Fitness** | Multiplicative fitness (Prop329\*Survival\*VegSize) |

DISCUSSION