

3.1 Vegetative characteristics



Figure S1. Correlation matrix plot with correlation coefficients and corresponding significance levels between vegetative characteristics and vase life. The diagonal boxes show the variable distributions split by cultivars. The lower boxes are composed of scatter plots and the upper boxes show the Pearson correlation coefficients with significance level (as asterisks) by cultivars. Each significance level is associated to a symbol: p-value 0.001 (***), 0.01 (**), 0.05 (*), and not significant (no asterisk).

Stem diameter

Stem diameter shows significant differences depending on the treatment group and cultivar, but SA treatment had no effect on increasing stem diameter at any concentration. (Figure S1). The stem diameter of the AG cultivar is not greatly affected by cultivation method, treatment timing, and SA concentration, whereas the other cultivars showed thicker stems when treated with SA in the R stage under S cultivation (SSR). The AG cultivar appears to have a clear genetic limit to increase stem diameter compared to other cultivars. In contrast to the reported high correlation between stem diameter and vase life, we found a very weak correlation between stem diameter and vase life in the cut lisianthus ($r = 0.052$) (Figure S2).

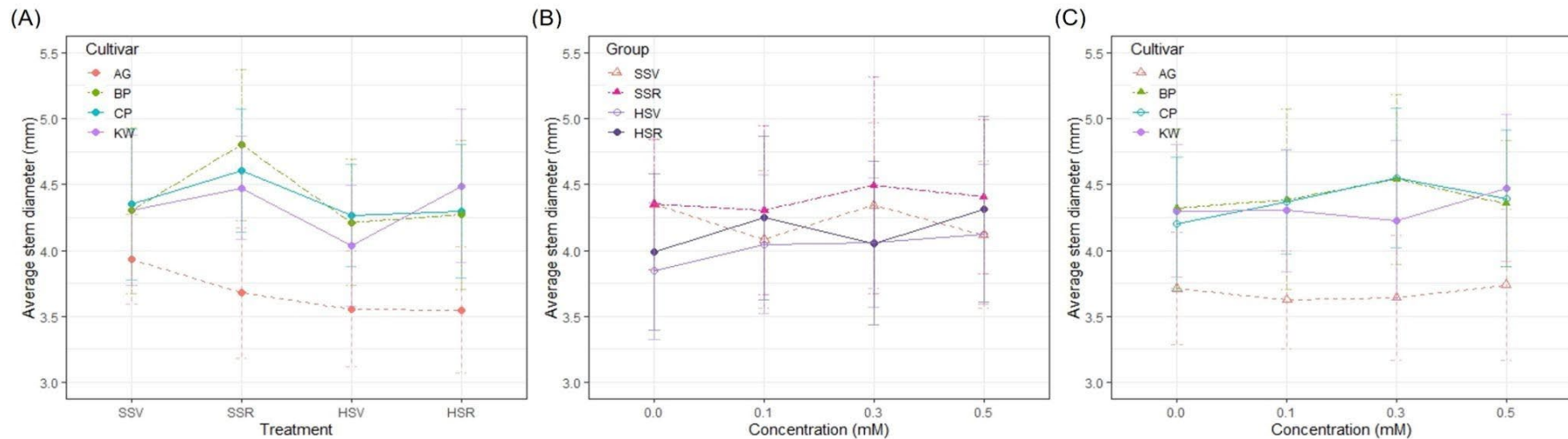


Figure S2. The effect of treatment groups according to the cultivar on the stem diameter (A), the effect of salicylic acid (SA) concentration according to the treatment group (B), and the effect of SA concentration according to the cultivar (C).

Number of stem nodes

Stem node is where leaves and buds emerge from the stem and it can influence the overall appearance of a floral arrangement. The more nodes there are, the easier it is for farmers to form new stems, leaves or flowers into the desired shape. Stem nodes show significant differences depending on the treatment group and cultivar, but they are not affected by SA concentration like stem diameter (Figure S3). In all treatment groups, the number of stem nodes is affected more by the genetic factor of the cultivar than by the environment. The AG cultivar is most suitable for increasing the number of stem nodes. However, the AG cultivar seems to have a smaller stem diameter due to the increased number of stem nodes.

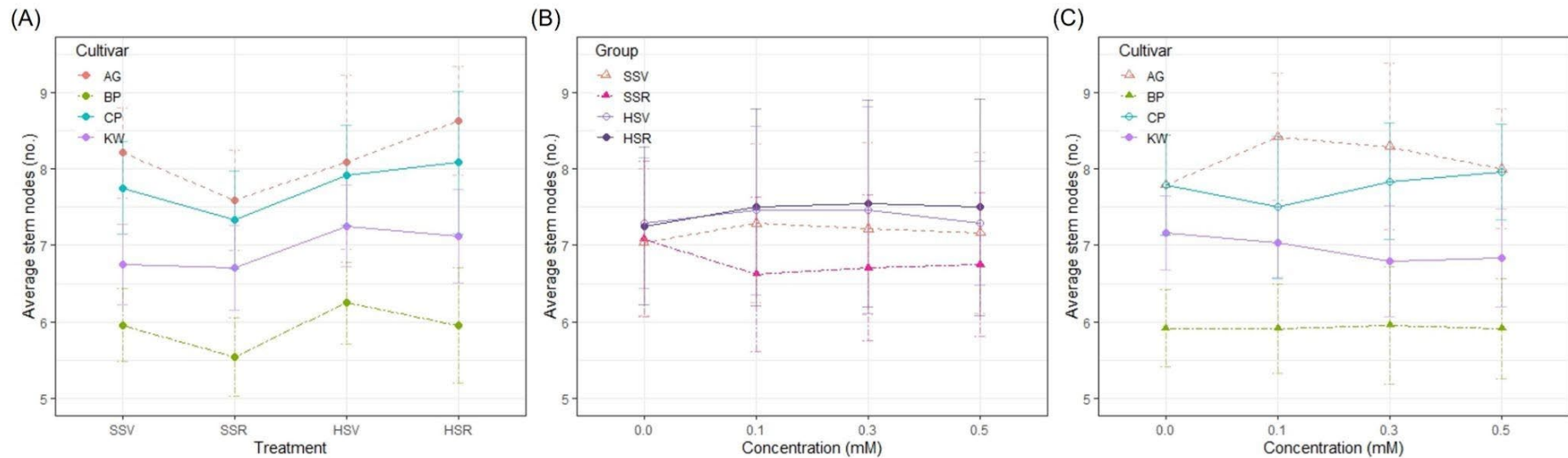


Figure S3. The effect of treatment groups according to the cultivar on the stem nodes (A), the effect of salicylic acid (SA) concentration according to the treatment group (B), and the effect of SA concentration according to the cultivar (C).

Stem length

Stem length showed an increasing trend in S cultivation compared to H cultivation (Figure S4). In S cultivation, the stem length did not differ depending on the timing of SA treatment, but stem length was greatly affected by the timing of SA treatment in H cultivation. The HSR group had a significantly smaller average stem length than the other treatment groups, and there was no difference in average stem length between treatment groups based on SA concentration. Among the four cultivars, only the CP cultivar showed a tendency for average stem length to increase with SA treatment. Stem length and vase life were found to have a weak inverse relationship with each other ($r = -0.211$) (Figure S2).

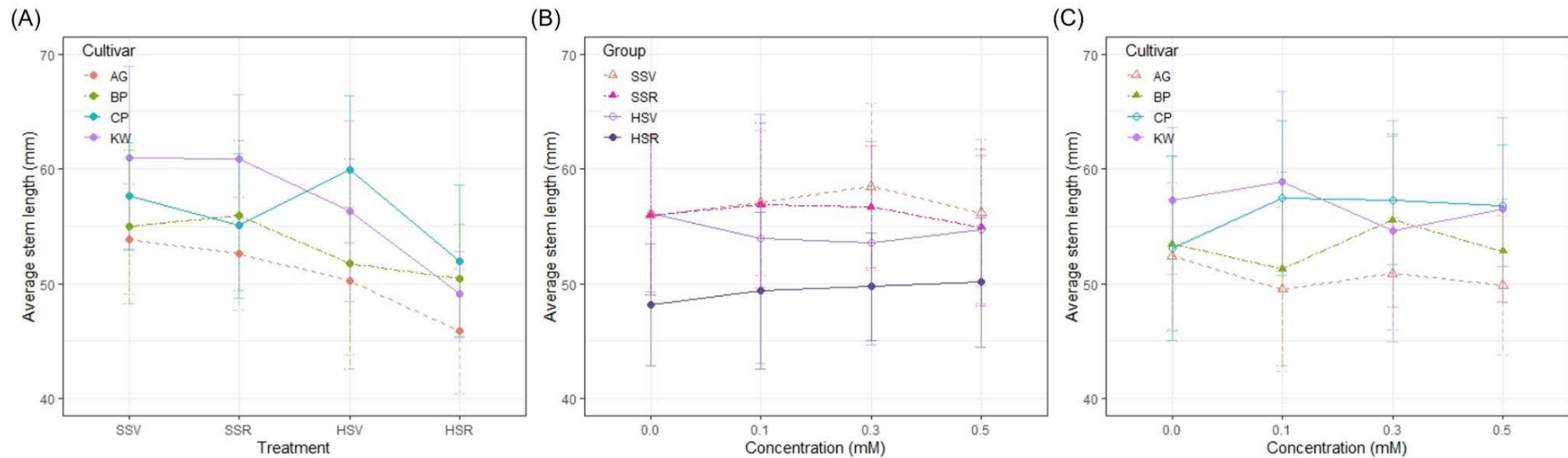


Figure S4. The effect of treatment groups according to the cultivar on the stem length (A), the effect of salicylic acid (SA) concentration according to the treatment group (B), and the effect of SA concentration according to the cultivar (C).

Number of stem bushes

Stem bush typically refers to the development of additional branches or lateral shoots that occur along the stem of a cut flower resulting in a denser arrangement of flowers, giving a fuller appearance. The stem bush is an indicator of the number of flowers per cut, and a greater number is associated with better cut flower quality. S cultivation results in an even larger bush number than H cultivation (Figure S5). In the HSV group, the average bush number for all cultivars was less than 3.0. Meanwhile, the BP cultivar in the SSR group shows the highest bush number, with a mean of 5.42. The number of stem bushes increased with higher concentration of SA in the R stage. Conversely, the bush number is not affected by SA concentration when treated in the V stage.

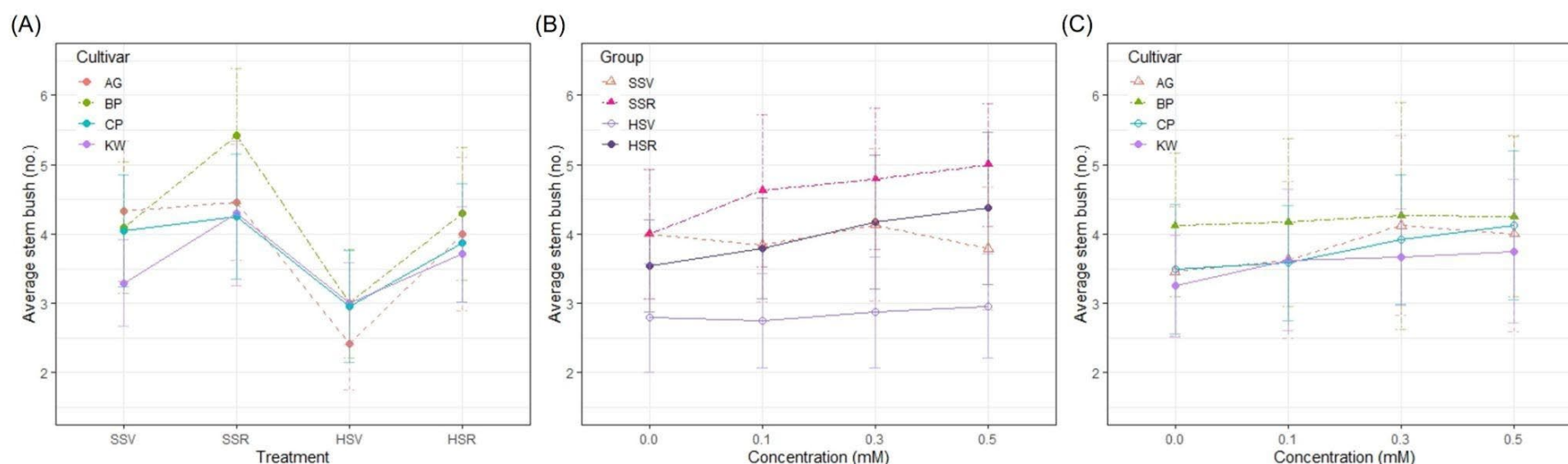


Figure S5. The effect of treatment groups according to the cultivar on the stem bush (A), the effect of salicylic acid (SA) concentration according to the treatment group (B), and the effect of SA concentration according to the cultivar (C).

Flowering day

Flowering day refers to the number of days required for a flower to bloom. The longer the flowering day, the longer the vase life becomes based on sufficient vegetative growth. The flowering day was significantly affected by the three factors ($p < 0.001$) (Figure S6). The flowering day was longer in the H cultivation groups than in the S cultivation groups, and was longer when SA was treated at the V stage compared to SA treatment at the R stage under H cultivation. There was a trend for a longer flowering day as SA concentration increased, except for the SSV treatment group. The AG cultivar had an average flowering day of 60.4 d in the SA-untreated control, while the BP cultivar had the longest average flowering day (68.6) at 0.5 mM SA. Flowering day has a weak correlation with vase life ($r = 0.223$) (Figure S2).

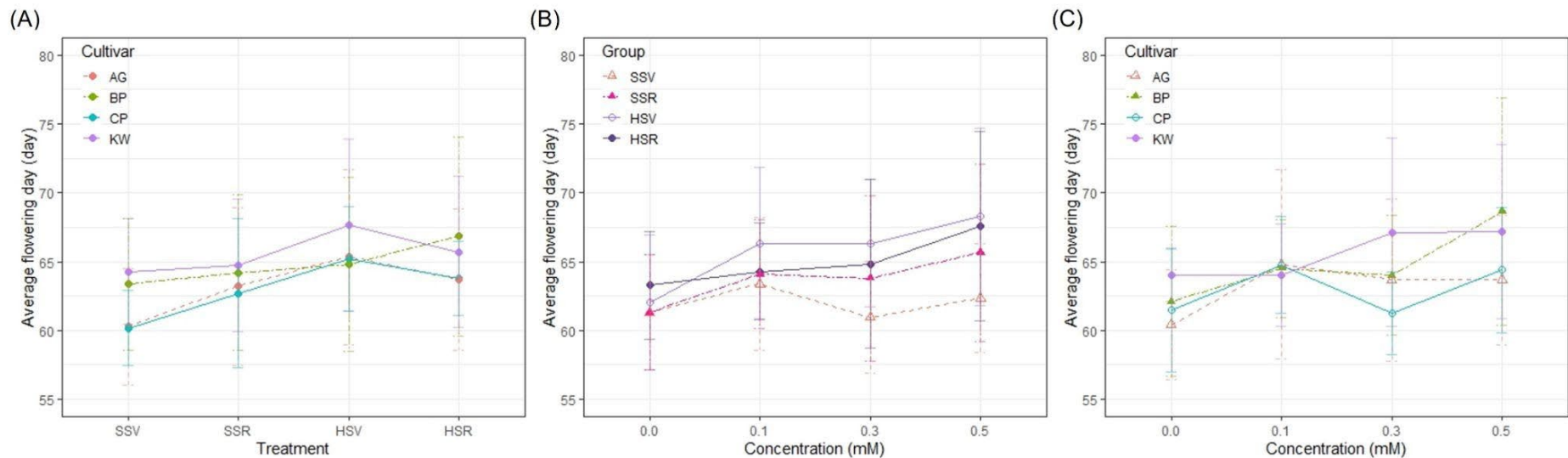


Figure S6. The effect of treatment groups according to the cultivar on the flowering day (A), the effect of salicylic acid (SA) concentration according to the treatment group (B), and the effect of SA concentration according to the cultivar (C).

3.2 Reproductive characteristics

Fresh weight

In this study, the average fresh weight was greatest when SA was treated in the V stage during H cultivation (HSV) and was not affected by SA concentration (Figure S7). Among the four cultivars, the KW cultivar showed the highest average fresh weight, and SA concentration did not affect the average fresh weight of each cultivar. The characteristics of each cultivar were clearly preserved in all SA concentrations. Thus, fresh weight is also strongly governed by the genetic factor of each cultivar. In this study, fresh weight was very weakly correlated with vase life ($r = 0.154$) (Figure 2), suggesting that increased fresh weight did not improve vase life as reported in previous studies.

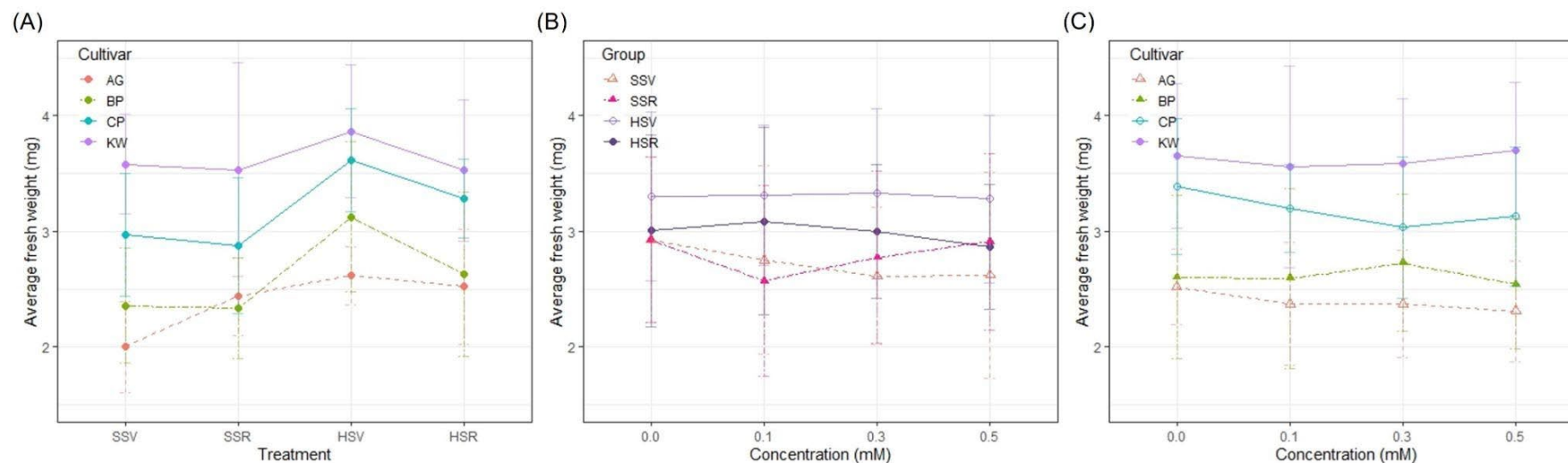


Figure S7. The effect of treatment groups according to the cultivar on the fresh weight (A), the effect of salicylic acid (SA) concentration according to the treatment group (B), and the effect of SA concentration according to the cultivar (C).

Weight difference

Weight difference is the difference between fresh weight and dry weight. It represents water content present in the plant tissue, excluding total organic and inorganic matter. Contrary to the results of dry weight, the lowest average weight difference was observed in the HSR group (Figure S8). There was no difference in the average weight difference between the SSV, SSR, and HSV groups, but there was significant difference in the HSR group. Similarly, there was no relationship between the SA concentration and average weight difference, but the HSR group showed a trend for smaller weight difference with increasing SA concentration. This is because the dry weight increased when the SA concentration was increased. For AG and BP cultivars, the average weight difference does not exceed 2 mg at all concentrations. The smaller this value, the greater the biomass.

There is a strong correlation between fresh weight and weight difference ($r = 0.708$) (Figure 2). Looking at the correlation between the two variables for each cultivar, CP ($r = 0.654$) has a strong correlation and BP ($r = 0.808$) has a very strong correlation, which is due to the high water content in the tissue of both cultivars. On the other hand, AG and KW have a weak to moderate relationship, indicating relatively little water content. There is a moderate negative correlation between dry weight and weight difference ($r = -0.448$). However, AG ($r = -0.632$) and KW ($r = -0.771$) cultivars have a strong negative correlation, showing the opposite result to Fresh weight. There is a weak negative correlation ($r = -0.234$) between weight difference and vase life. Only the KW cultivar showed a moderate correlation ($r = -0.486$). As mentioned earlier, just as fresh weight is not a relatively important variable for estimating vase life due to its low correlation with vase life, weight difference also cannot be said to be an important variable in estimating vase life.

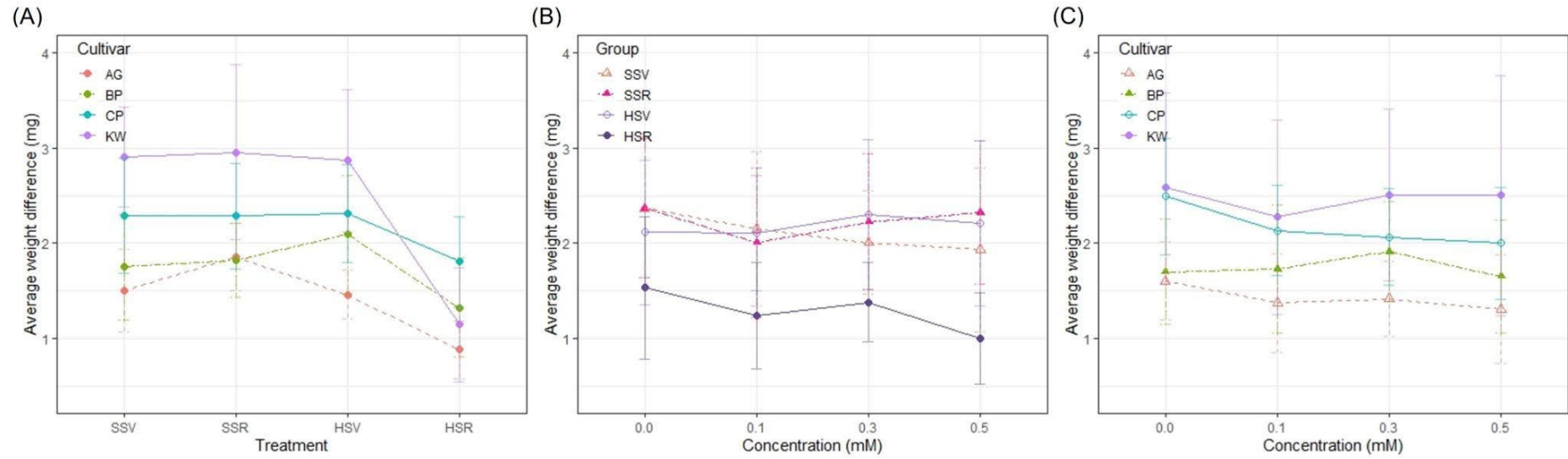


Figure S8. The effect of treatment groups according to the cultivar on the weight difference (A), the effect of salicylic acid (SA) concentration according to the treatment group (B), and the effect of SA concentration according to the cultivar (C).

Number of petals

Conventional wisdom holds that flowers with more petals may tend to have a shorter vase life compared to flowers with fewer petals. Because flowers with more petals have a higher respiration rate, they have a rapid senescence. The average number of petals increased significantly in the HSV group with only BP and CP cultivars (Figure S9). In all treatment groups, petal number decreased with increasing SA concentration. In addition, the number of petals had a significant cultivar-specific effect, showing different patterns of increase or decrease depending on the cultivar with increasing SA concentration. In our research, it has been revealed that there is no correlation between petal number and vase life ($r = 0.035$) (Figure 2).

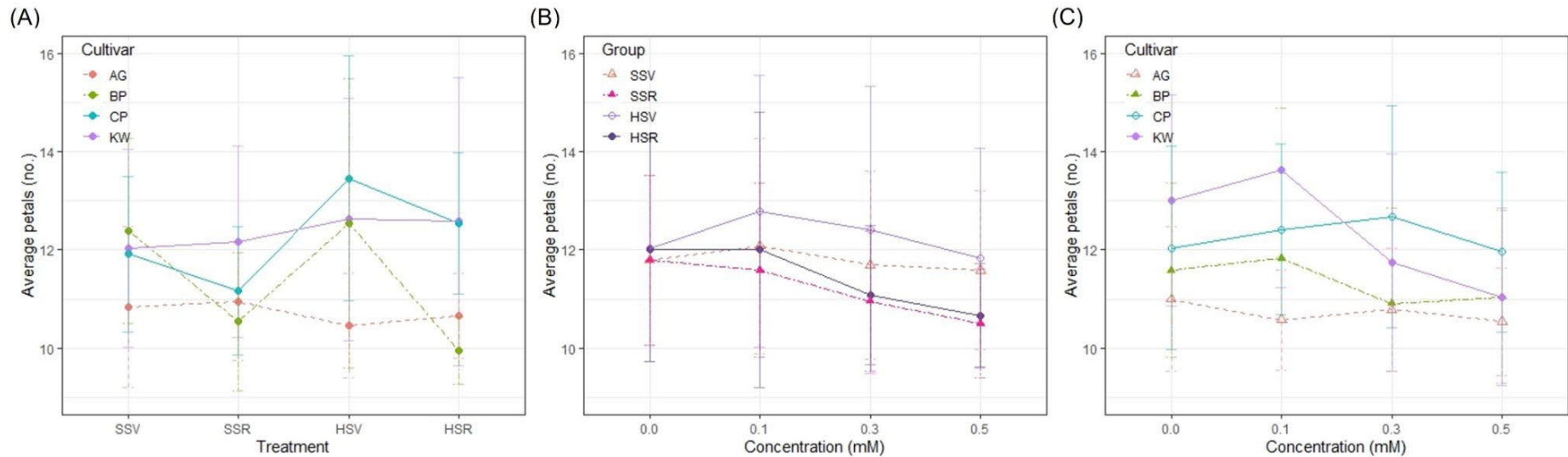


Figure S9. The effect of treatment groups according to the cultivar on the petals (A), the effect of salicylic acid (SA) concentration according to the treatment group (B), and the effect of SA concentration according to the cultivar (C).

Petal size

From the perspective of a potential buyer of cut flowers, large petal size increases appeal. As can be seen in Figure S10, average petal size was highest in the HSR group. In the SSR group, average petal size increased up to 51.4 mm with increasing SA concentration. In contrast, SA treatment led to decrease in petal size in the HSV group. For all four cultivars, the changes in average petal size with SA concentration were not statistically significant, but except for KW, the other cultivars showed a tendency for petal size to increase with increasing SA concentration. Petal size was also a characteristic with a cultivar-specific response, and the CP cultivar produced genetically cut flowers with a large petal size. While the KW cultivar was the only one that showed a decrease in average petal size with increasing SA concentration. There is no correlation between petal size and vase life (Figure 2).

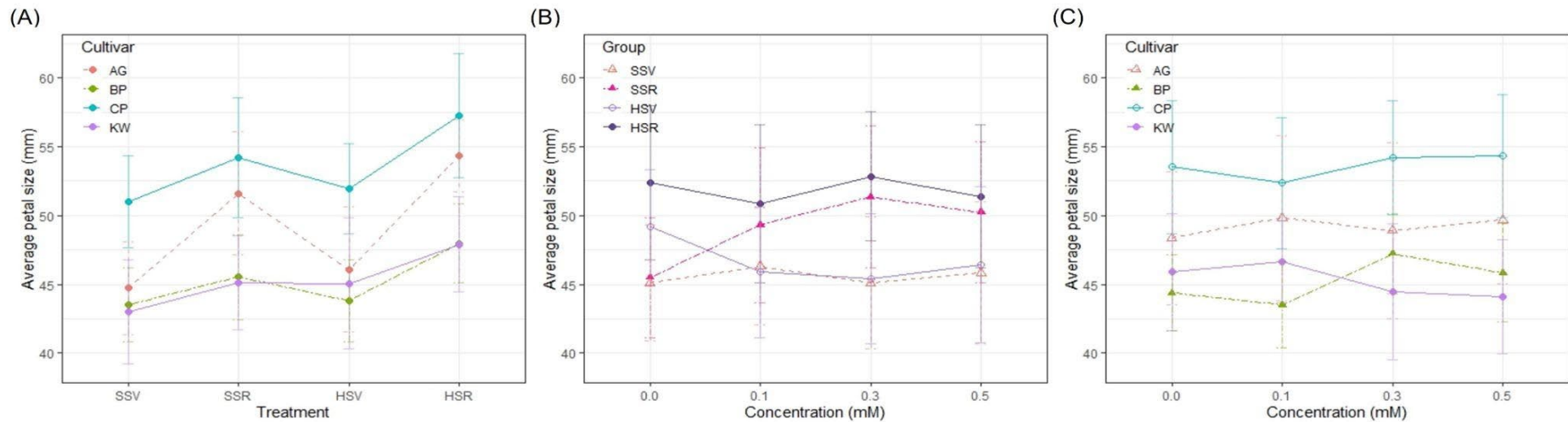


Figure S10. The effect of treatment groups according to the cultivar on the petal size (A), the effect of salicylic acid (SA) concentration according to the treatment group (B), and the effect of SA concentration according to the cultivar (C).

3.3 Chemical components from leaf analysis in vegetative period

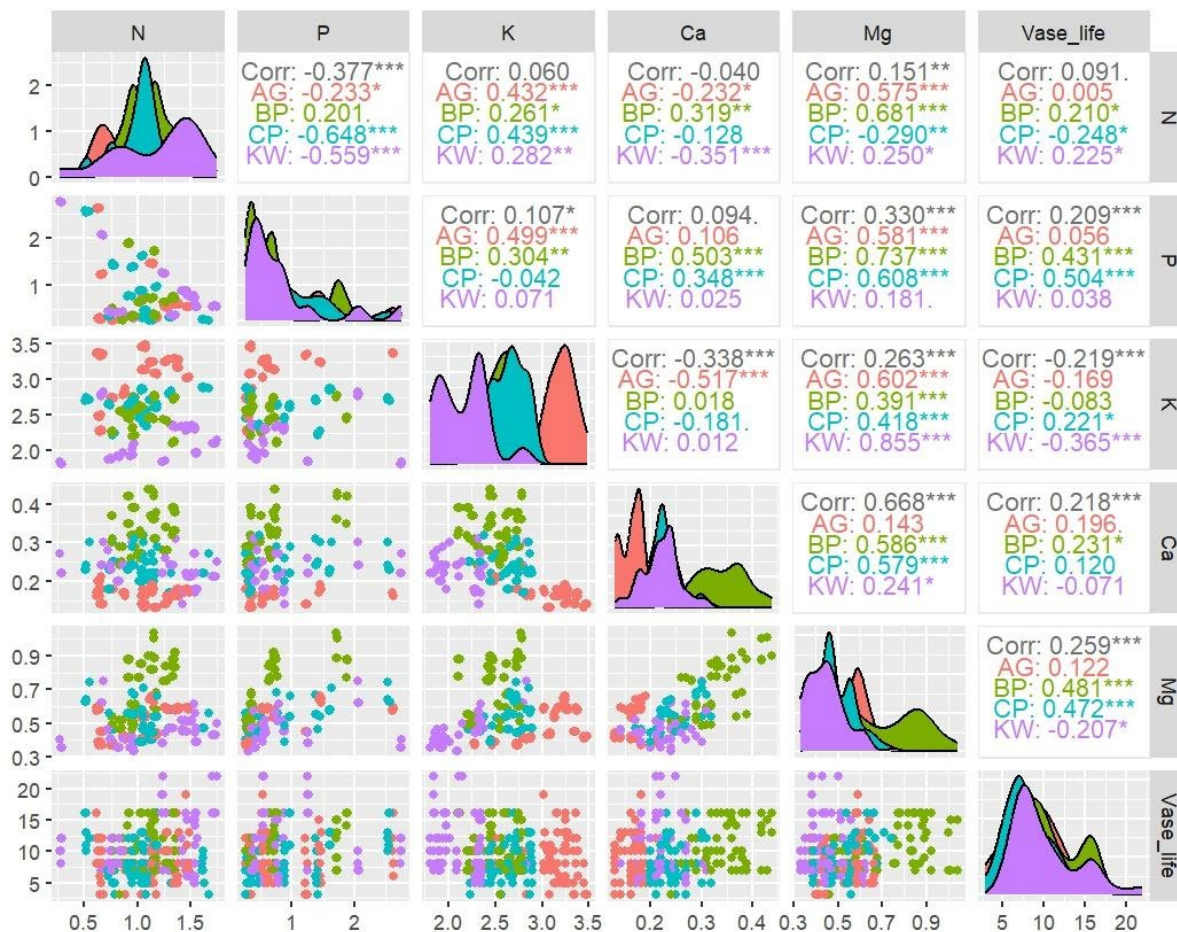


Figure S11. Correlation matrix plot with correlation coefficients and corresponding significance levels between chemical components and vase life. The diagonal boxes show the variable distributions split by cultivars. The lower boxes are composed of scatter plots and the upper boxes show the Pearson correlation coefficients with significance level (as asterisks) by cultivars. Each significance level is associated to a symbol: p-value 0.001 (***), 0.01 (**), 0.05 (*), and not significant (no asterisk).

Chlorophyll is a biochemical compound that plays an important role in photosynthesis, and chlorophyll content is positively correlated with total N content [3]. The average N content of the H cultivation group was statistically significantly higher than those of the S cultivation group (Figure S11). In particular, the average N content of the KW cultivar increased significantly in the H cultivation group compared to other cultivars. In the S cultivation group, the average N content decreased significantly as the SA concentration increased, but the H cultivation group remained similar to the control, indicating that SA treatment had no effect at all. All cultivars show a trend of decreasing N content with increasing SA concentration. In other words, N content is strongly influenced by cultivation method and cultivar, but the treatment timing and concentration of SA had no effect.

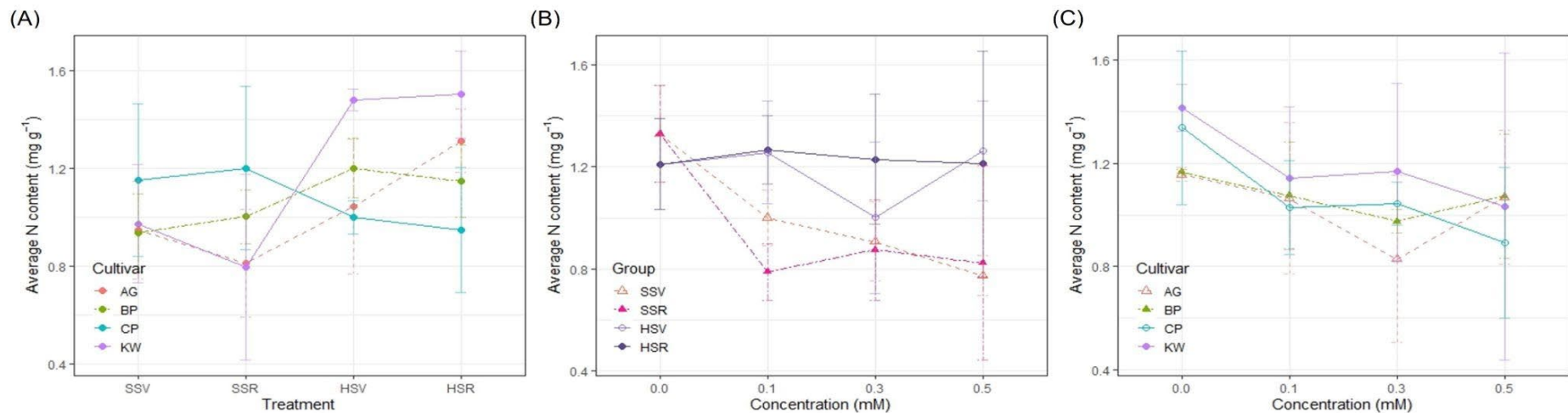


Figure S12. The effect of treatment groups according to the cultivar on the nitrogen content (A), the effect of salicylic acid (SA) concentration according to the treatment group (B), and the effect of SA concentration according to the cultivar (C).

The average P content differed depending on the treatment group, similar to the N content (Figure S12). The average P content of the S cultivation group increased as the SA concentration increased, but the H cultivation group showed a tendency to decrease depending on the SA concentration.

The P contents of BP and CP cultivars have moderate correlations with vase life ($r = 0.431, 0.504$, respectively) (Figure S13).

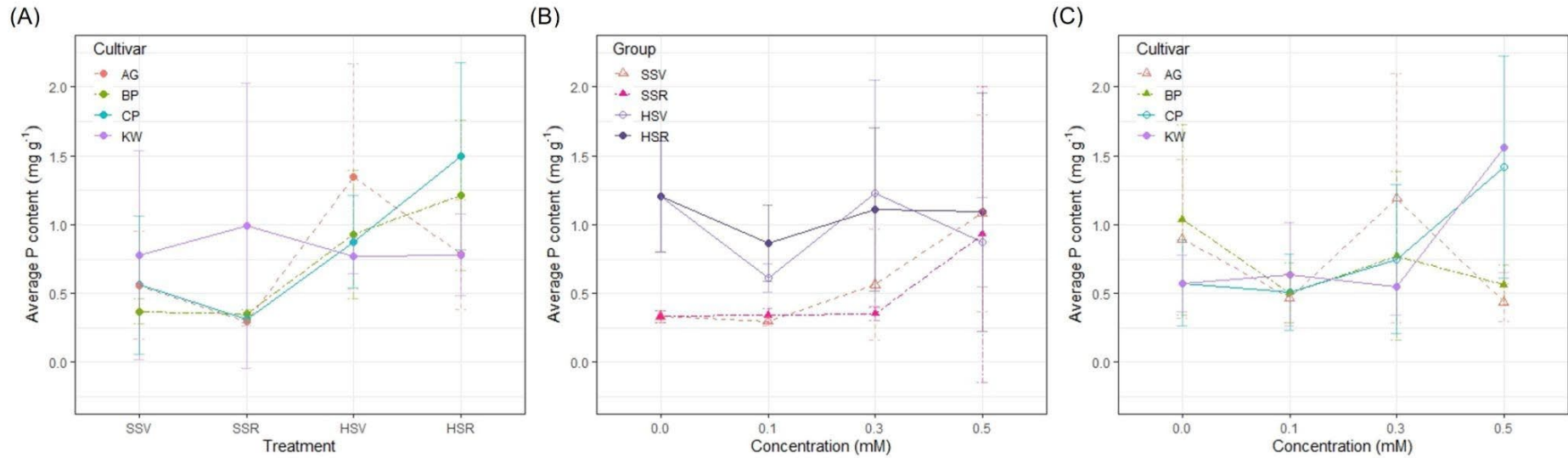


Figure S13. The effect of treatment groups according to the cultivar on the phosphorus content (A), the effect of salicylic acid (SA) concentration according to the treatment group (B), and the effect of SA concentration according to the cultivar (C).

K content shows a cultivar-specific response, with statistically significant differences in all four cultivars (Figure S14). In particular, the AG cultivar had a significantly higher K content than the other cultivars.

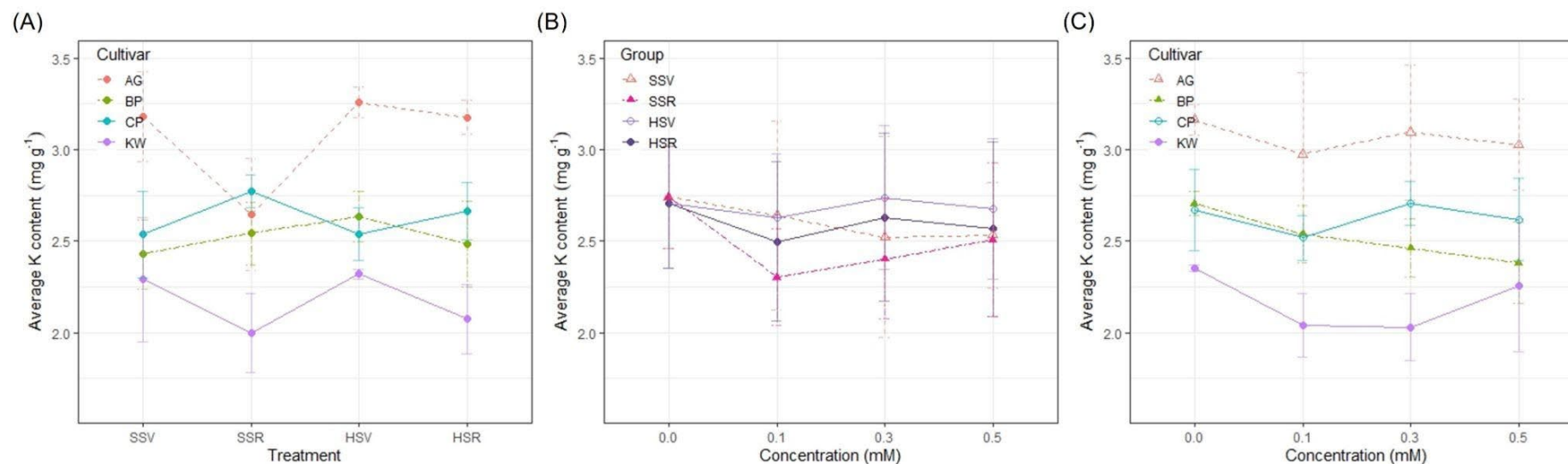


Figure S14. The effect of treatment groups according to the cultivar on the potassium content (A), the effect of salicylic acid (SA) concentration according to the treatment group (B), and the effect of SA concentration according to the cultivar (C).

Mg is a central atom of chlorophyll and plays a major role in photosynthesis [1,2], Like N and P content, Mg content was higher in the H cultivation groups than in the S cultivation groups (Figure S15). It can be seen that the effect of SA treatment timing and concentration on Mg content was small, but the effect of genetic factor was large. The Mg contents of BP and CP cultivars have moderate correlations with vase life ($r = 0.481, 0.472$, respectively) (Figure S13).

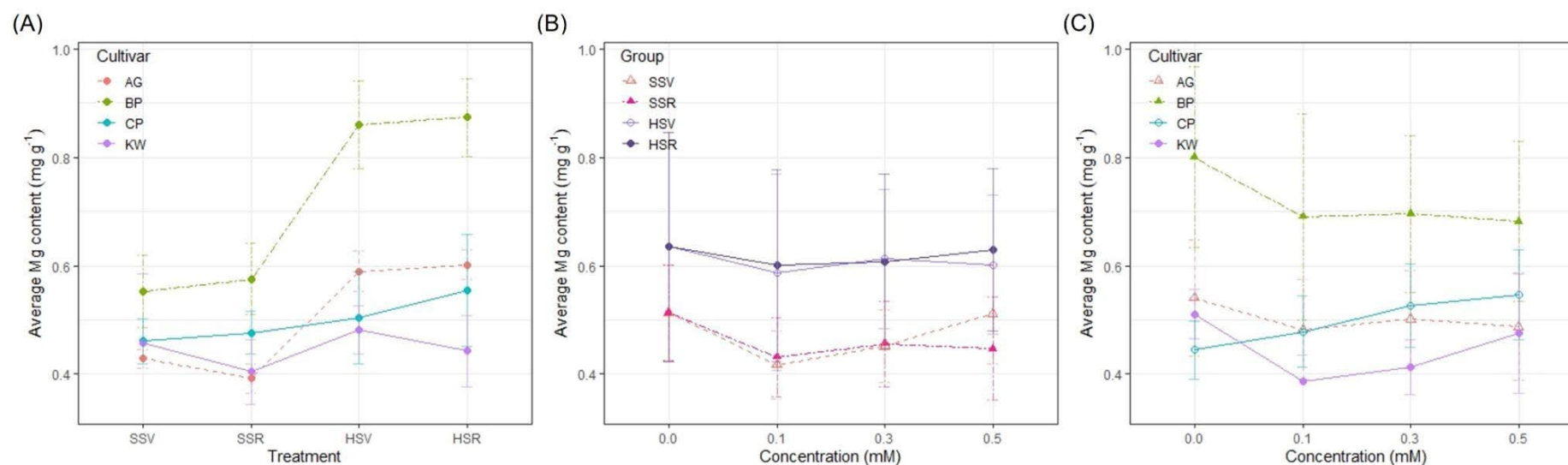


Figure S15. The effect of treatment groups according to the cultivar on the magnesium content (A), the effect of salicylic acid (SA) concentration according to the treatment group (B), and the effect of SA concentration according to the cultivar (C).

Ca content varied with cultivar-specific response, as did Mg content. Similar to K and Mg content, Ca content also appears to be under homeostatic control (Figure S16).

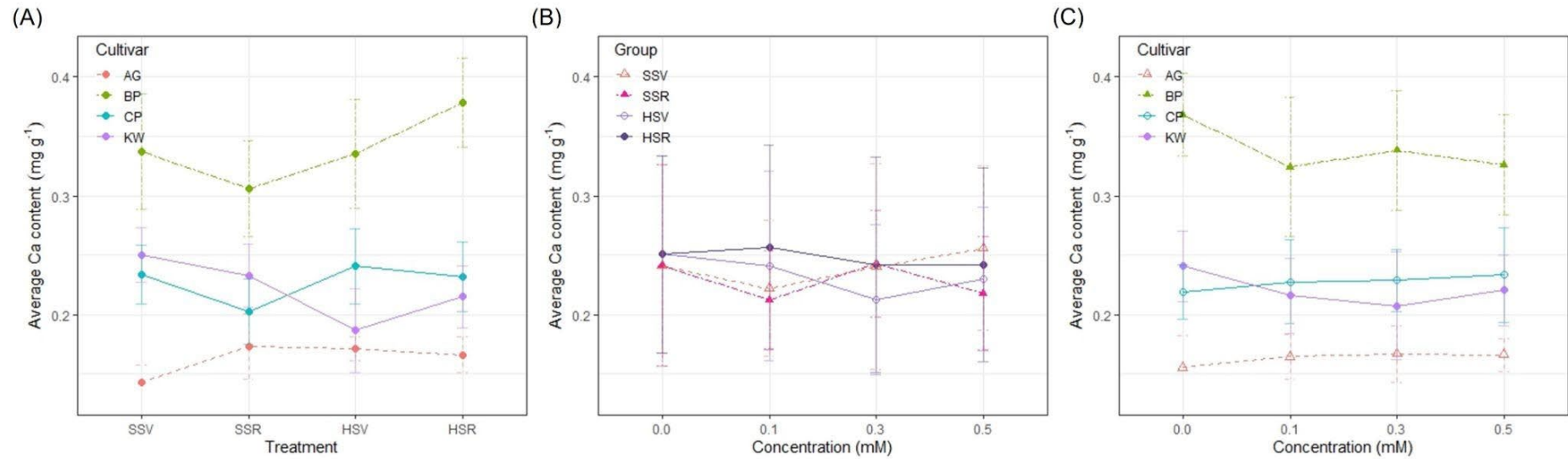


Figure S16. The effect of treatment groups according to the cultivar on the calcium content (A), the effect of salicylic acid (SA) concentration according to the treatment group (B), and the effect of SA concentration according to the cultivar (C).

References

1. Evans, J.R.; Clarke, V.C. The nitrogen cost of photosynthesis. *J. Exp. Bot.* 2019, 70, 7–15.
2. Hermans, C.; Vuylsteke, M.; Coppens, F.; Cristescu, S.M.; Harren, F.J.; Inze, D.; Verbruggen, N. Systems analysis of the responses to long-term magnesium deficiency and restoration in *Arabidopsis thaliana*. *New Phytol.* 2010, 187, 132–144.
3. Mu, X.; Chen, Q.; Chen, F.; Yuan, L.; Mi, G. Within-leaf nitrogen allocation in adaptation to low nitrogen supply in maize during grain-filling stage. *Front. Plant Sci.* 2016, 24, 699.