

Table S1. Soil physical and chemical proprieties of the KAU Agriculture Research Station at Hada AlSham, Al-Jamoom, Saudi Arabia.

pH (unit)	EC (ds/m)	Sandy Loam Soil particle size (%)			Organic matter (%)	Organic carbon (%)			Available macro nutrients (%)		
		Sand	Silt	Clay					N	P	K
7.83	1.79	84.21	14.05	1.74	0.453	0.500			0.215	0.070	0.781
Total elements (mg/kg)											
Cr	Pb	Ni	Cd	Mn	Fe	Ca (%)	Mg (%)	Cu	Zn	Na (%)	
0.11	4.21	0.52	0.06	144.44	239.40	1.38	1.15	4.78	32.98	0.14	

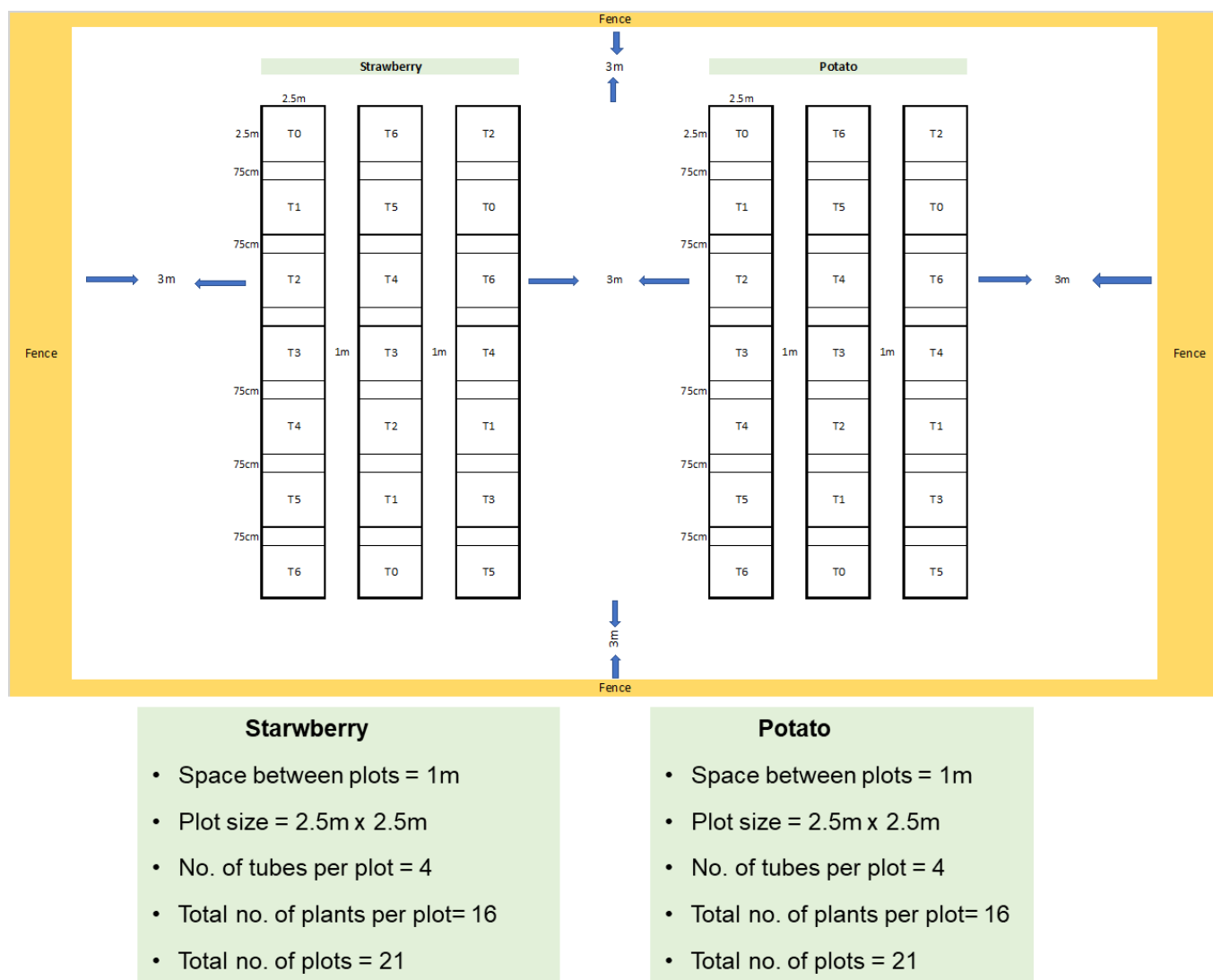


Figure S1. Experimental field layout in KAU station.

(A)



(B)

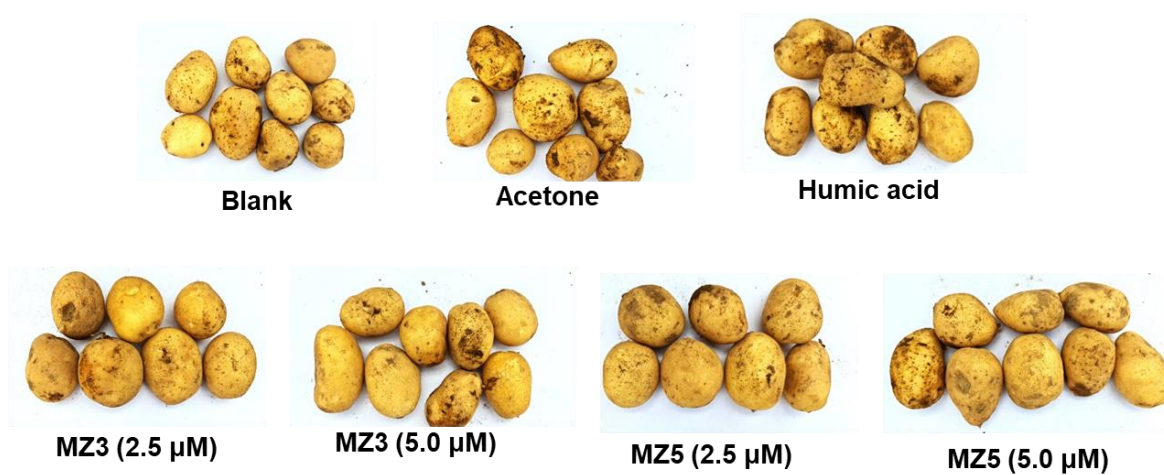


Figure S2. (A). Field pictures of potato plants treated with acetone or MiZax3 under desert conditions. (B). Pictures of potatoes harvested from different treatment. HA, humic acid; MZ3, MiZax3; MZ5, MiZax5.

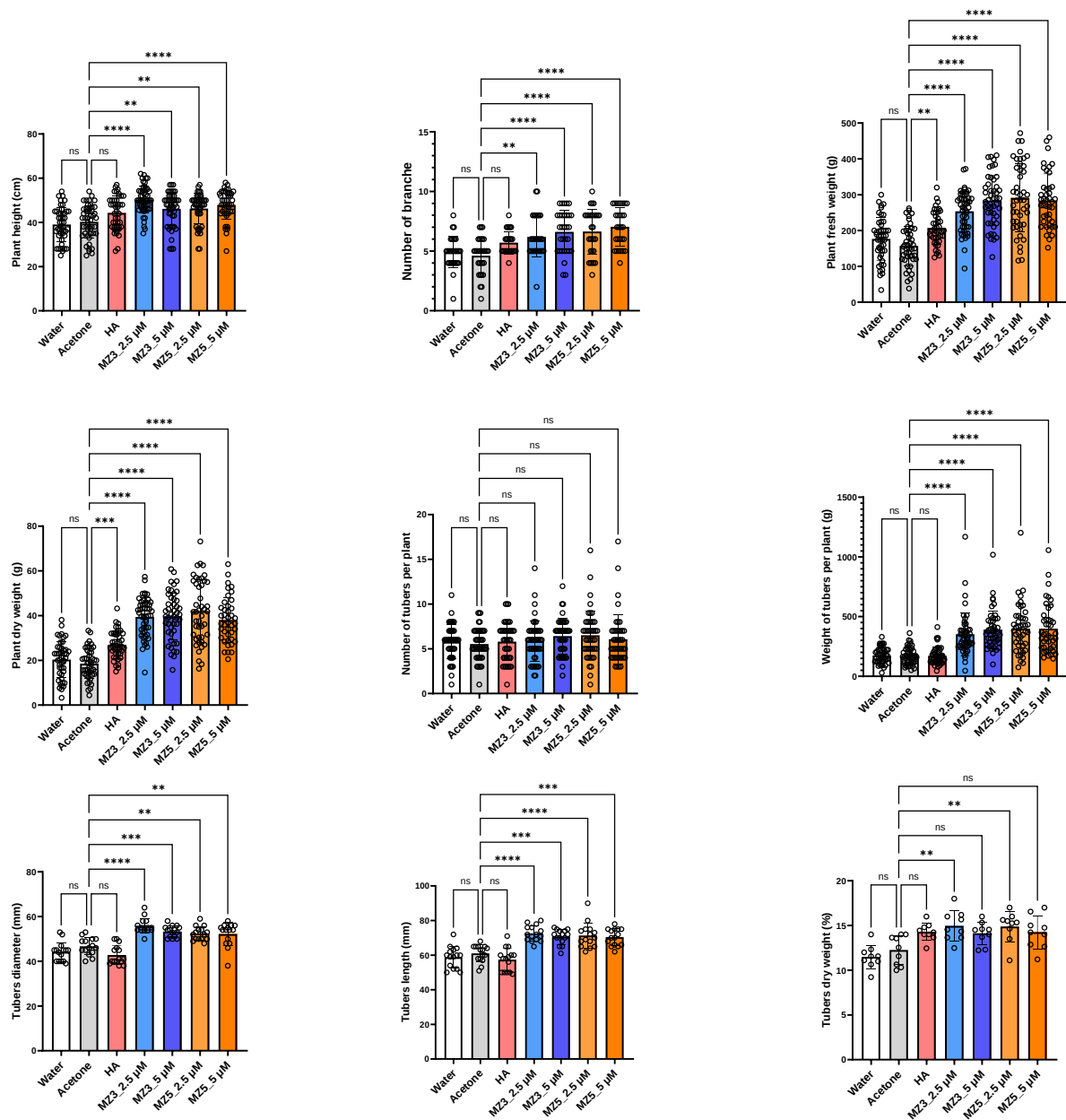


Figure S3. Phenotyping of MiZax effect on late cropping potato plants from the field of KAU, performed in 2022. Data represent mean $\pm$ SD. $n \geq 15$. Statistical analysis was performed using One-way analysis of variance (ANOVA) and Tukey's post hoc test. Asterisks indicate statistically significant differences as compared to mock (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, **** $p < 0.0001$; ns, non-significant). HA, humic acid; MZ3, MiZax3; MZ5, MiZax5. HA, humic acid; MZ3, MiZax3; MZ5, MiZax5.

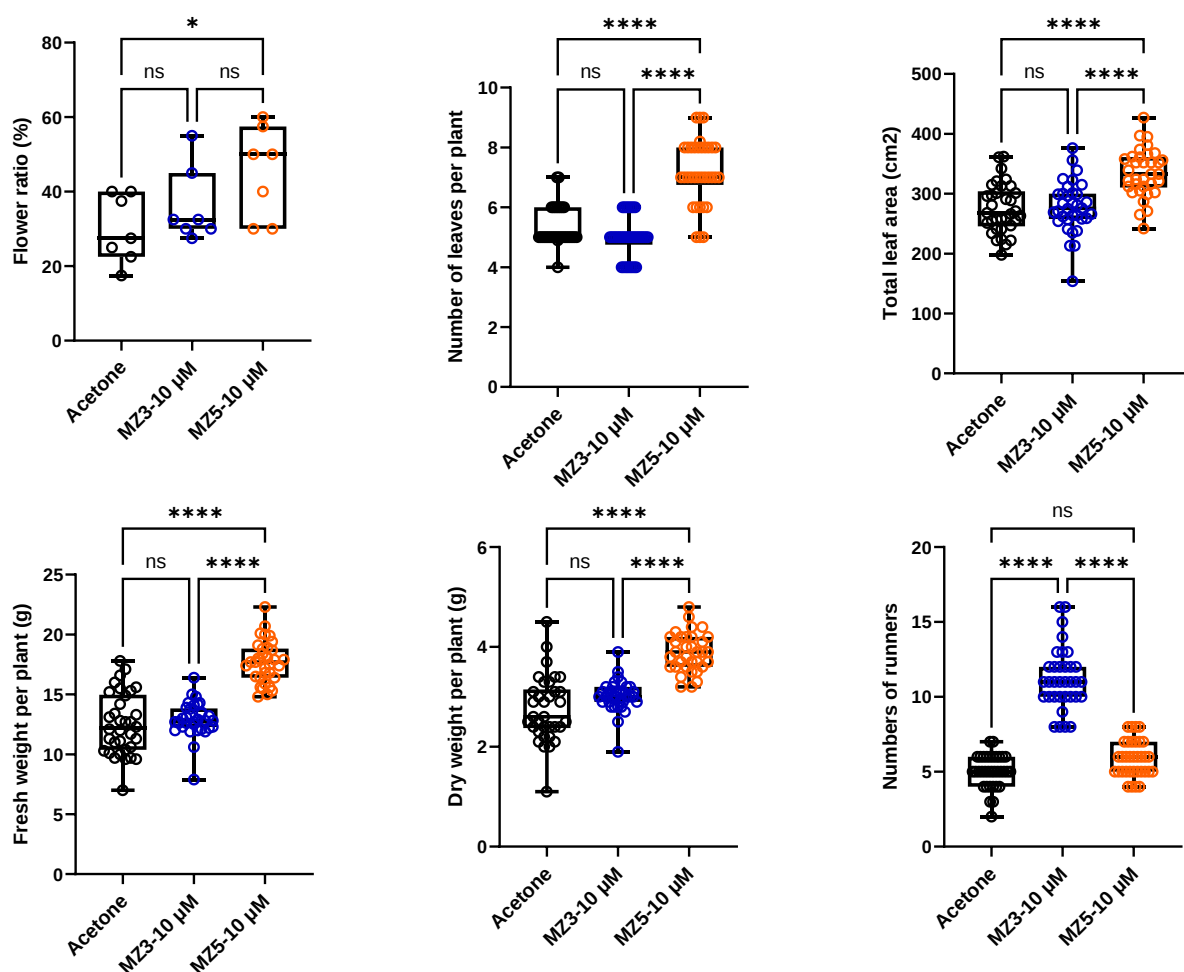


Figure S4. MiZax effect on strawberry (*Fragaria X ananassa* Duch cv Festival) grown under greenhouse conditions, performed in 2021. Data represent mean $\pm$ SD. n =34. Statistical analysis was performed using One-way analysis of variance (ANOVA) and Tukey's post hoc test. Asterisks indicate statistically significant differences as compared to mock (*p < 0.05, **p< 0.01, ***p< 0.001, ****p< 0.0001; ns, non-significant). MZ3, MiZax3; MZ5, MiZax5.

(A)



(B)

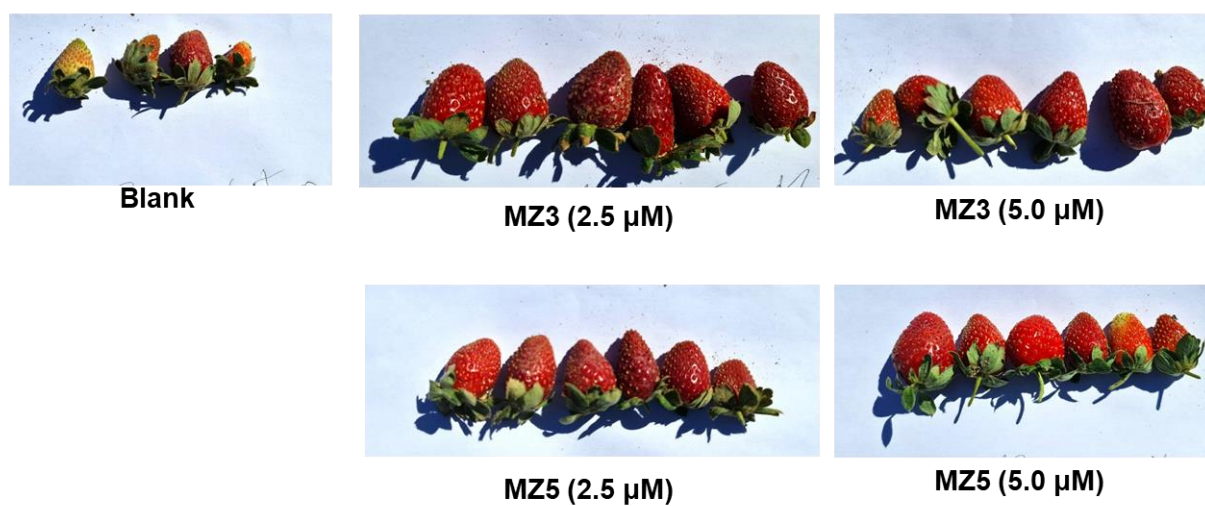
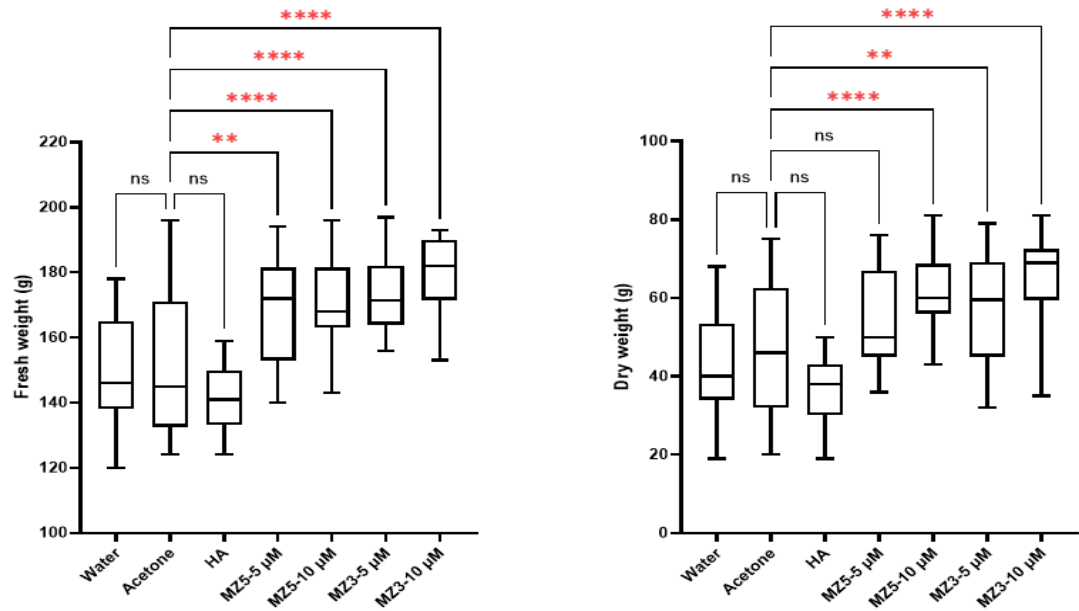


Figure S5. (A). Field pictures of strawberry plants grown under desert conditions. (B). Pictures of harvested strawberry among different treatment. HA, humic acid; MZ3, MiZax3; MZ5, MiZax5.

(A)



(B)

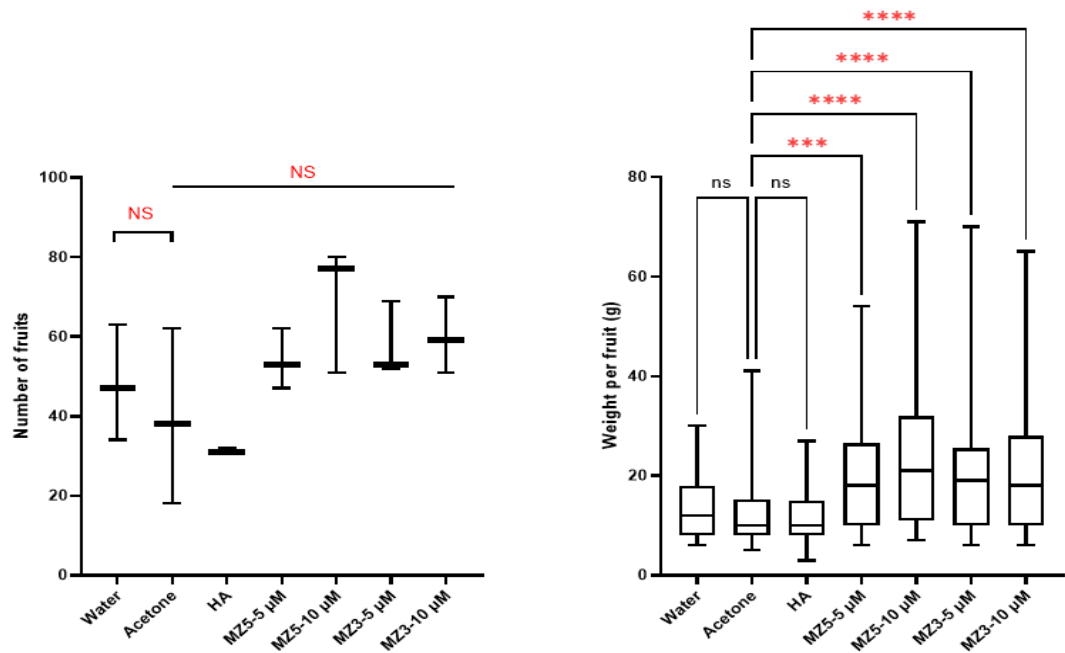


Figure S6. (A). Phenotyping of strawberry plants treated with MiZax in KAU field, performed in 2021. **(B).** Evaluation of strawberry fruits upon MiZax treatment. Data represent mean $\pm$ SD. $n \geq 10$. Statistical analysis was performed using One-way analysis of variance (ANOVA) and Tukey's post hoc test or using two-tail student t -test. Asterisks indicate statistically significant differences as compared to mock (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, **** $p < 0.0001$; ns, non-significant). HA, humic acid; MZ3, MiZax3; MZ5, MiZax5.

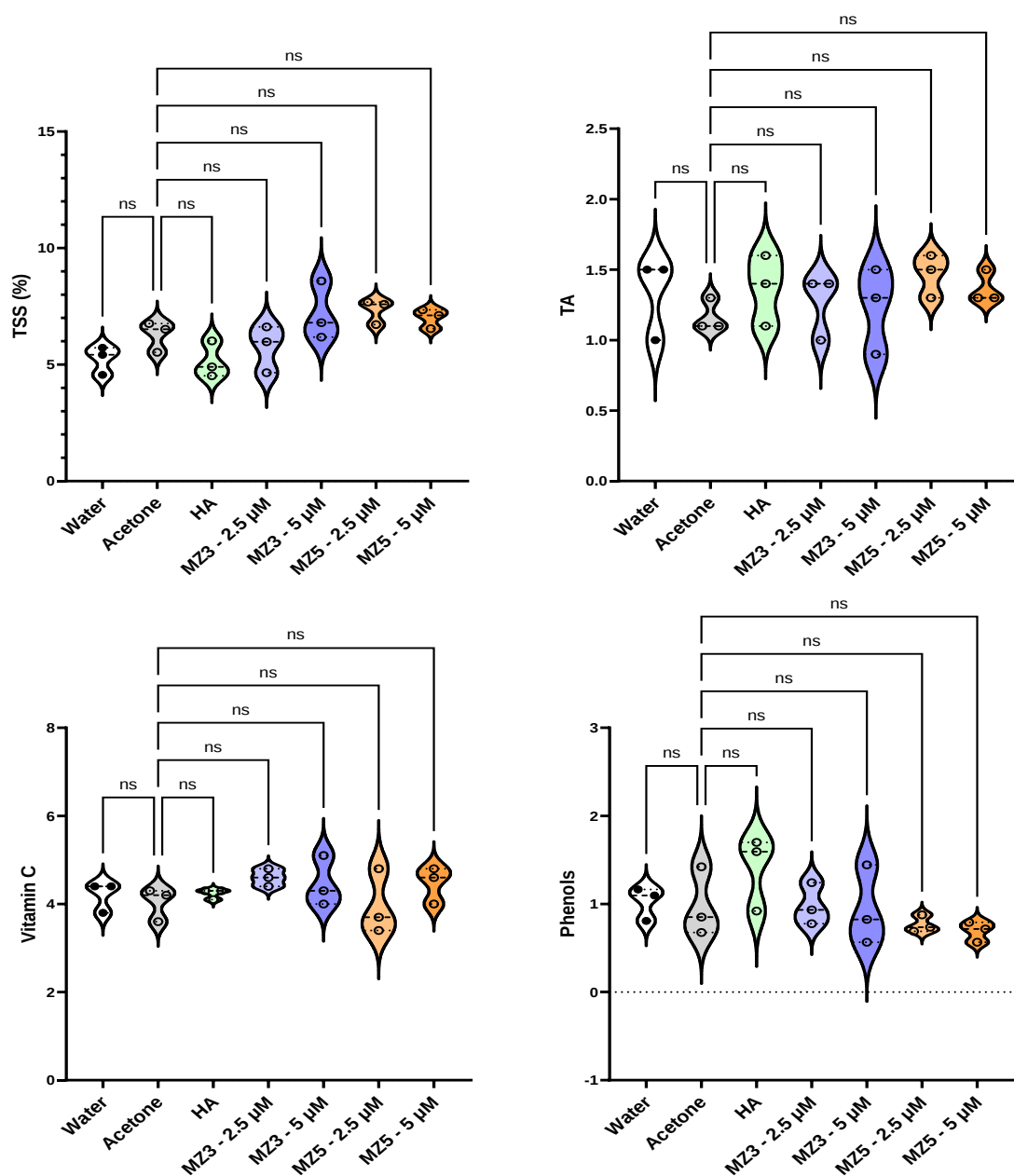


Figure S7. Biochemical analysis of strawberry (cv Sweet Charlie) fruits upon MiZax treatment in the field of KAU, performed in 2022. Data represent mean $\pm$ SD. $n=3$. Statistical analysis was performed using One-way analysis of variance (ANOVA) and Tukey's post hoc test or using two-tail student t -test. Asterisks indicate statistically significant differences as compared to mock ($*p < 0.05$, $**p < 0.01$, $***p < 0.001$, $****p < 0.0001$; ns, non-significant). HA, humic acid; MZ3, MiZax3; MZ5, MiZax5.

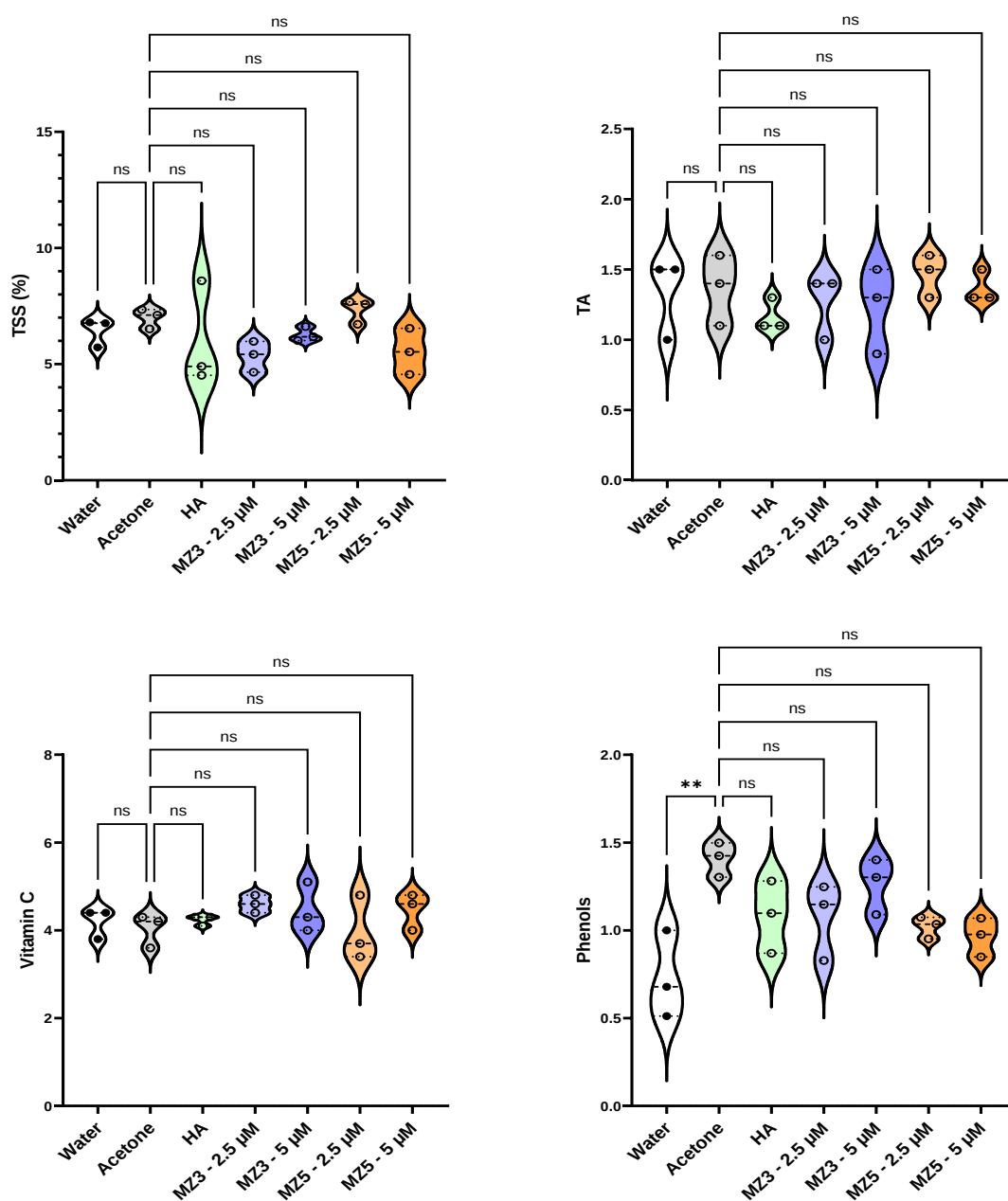


Figure S8. Biochemical analysis of strawberry (cv Festival) fruits upon MiZax treatment in the field of KAU, performed in 2022. Data represent mean $\pm$ SD. $n = 3$. Statistical analysis was performed using One-way analysis of variance (ANOVA) and Tukey's post hoc test or using two-tail student t -test. Asterisks indicate statistically significant differences as compared to mock ($*p < 0.05$, $**p < 0.01$, $***p < 0.001$, $****p < 0.0001$; ns, non-significant). HA, humic acid; MZ3, MiZax3; MZ5, MiZax5.