Table S1. Nutrient composition of the test–modified Hoagland nutrient solution.

Composition	$mg \cdot L^{-1}$
$Ca(NO_3)_2 \cdot 4H_2O$	945
KNO_3	506
NH_4NO_3	80
KH_2PO_4	126
$MgSO_4$	241
FeNaEDTA	36.7
KI	0.83
H_3BO_3	6.2
$MnSO_4 \cdot H_2O$	16.9
$ZnSO_4 \cdot 7H_2O$	8.6
$Na_2MoO_4 \cdot 2H_2O$	0.25
$CuSO_4 \cdot 5H_2O$	0.025
$CoCl_2 \cdot 6H_2O$	0.025
Totals	1977.53
pH (25 °C)	5.8 ± 0.2

Excess Na^+ is one of the leading causes of saline–alkali stress. When excessive Na^+ uptake occurs, it competes for K^+ sites on the intracellular and plasma membranes, inhibiting K^+ uptake and disrupting the cellular Na–K balance. Our study showed (Figure S1) that saline–alkali stress significantly increased the Na/K ratio of oat seedlings, with the S45 treatment increasing the Na/K ratio by 1414.10% compared to the CK treatment, while the S+MT treatment increased the Na/K percentage by 680.23% compared to the CK treatment; after MT treatment, the Na/K ratio of the S+MT treatment decreased by 48.47% compared to that after S45 treatment, and the difference between treatments was significant ($p \leqslant 0.01$). This indicates that MT application reduces Na^+ uptake by oat seedlings and promotes cellular Na–K homeostasis.

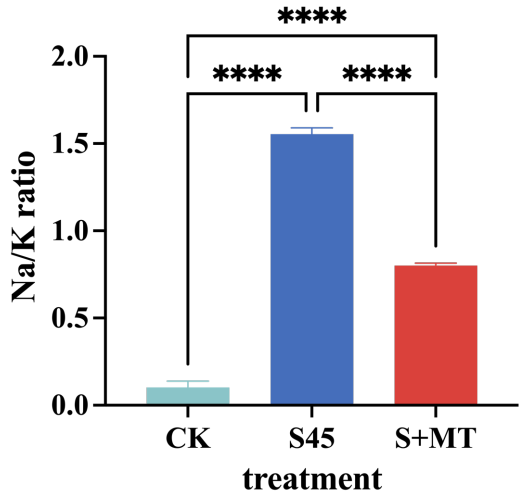

Figure S1. Changes in the Na-K ratio of oats between different treatments at 7 d after MT treatment. CK: normal culture with 50% Hoagland nutrient solution; S45: 45 mmol·L^{-1} saline–alkali stress culture; S+MT: 45 mmol·L^{-1} saline–alkali stress with 100 μmol·L^{-1} MT treatment. Among them, ****–significant ($p \leqslant 0.01$).

Hierarchical clustering analysis of mineral ions in oat seedlings under different treatments showed (Figure S2) that the contents of Na, Ni, Ca, Mn, Hg, Ti, S, and B were significantly higher after S45 treatment compared to CK treatment, while the contents of Ni, Ca, Mn, Al, Hg, Ti, Na, and S were significantly higher in seedlings after MT treatment compared to CK treatment. After MT treatment, the P, K, Ca, Mg, Fe, Mn, Cu, Zn, Ni, Co, Mo, Cd, Hg, Al, Se and Ti contents were significantly higher in the S+MT group than in the S45 group. Under normal culture conditions, the contents of P, K, Mg, Fe, Cu, Zn, Co, Mo, Cd, Se, and Si in oat seedlings were significantly increased compared with other treatments, while the S45 group showed significantly decreased contents of P, K, Mg, Fe, Cu, Zn, Co, Mo, Cd, Se, and Al but a significantly increased uptake of Na, S, and B compared with the CK treatment group; in the S+MT

treatment group, the contents of P, K, Mg, Fe, Cu, Zn, Co, Mo, Cd, Se, B, and Si in oat seedlings were decreased compared with those in the CK group.

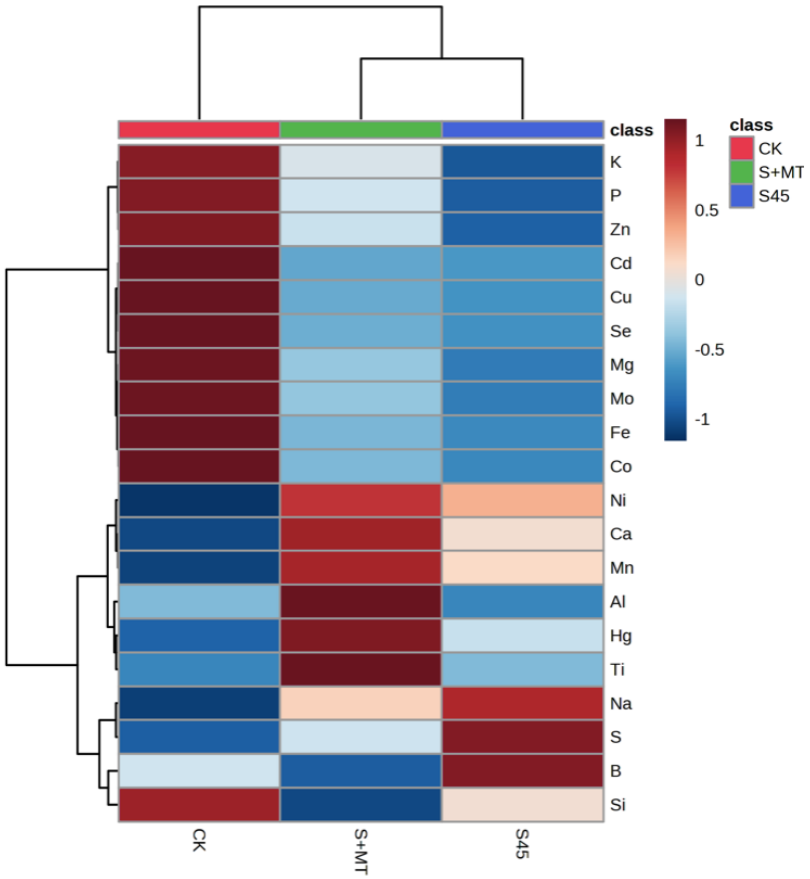

Figure S2. Cluster analysis of ion clusters of oat seedlings under different treatments (control (CK), saline–alkali stress (S45), and saline–alkali stress + MT treatment (S+MT)) after MT treatment; color intensity in the upper right corner shows their relative values.