



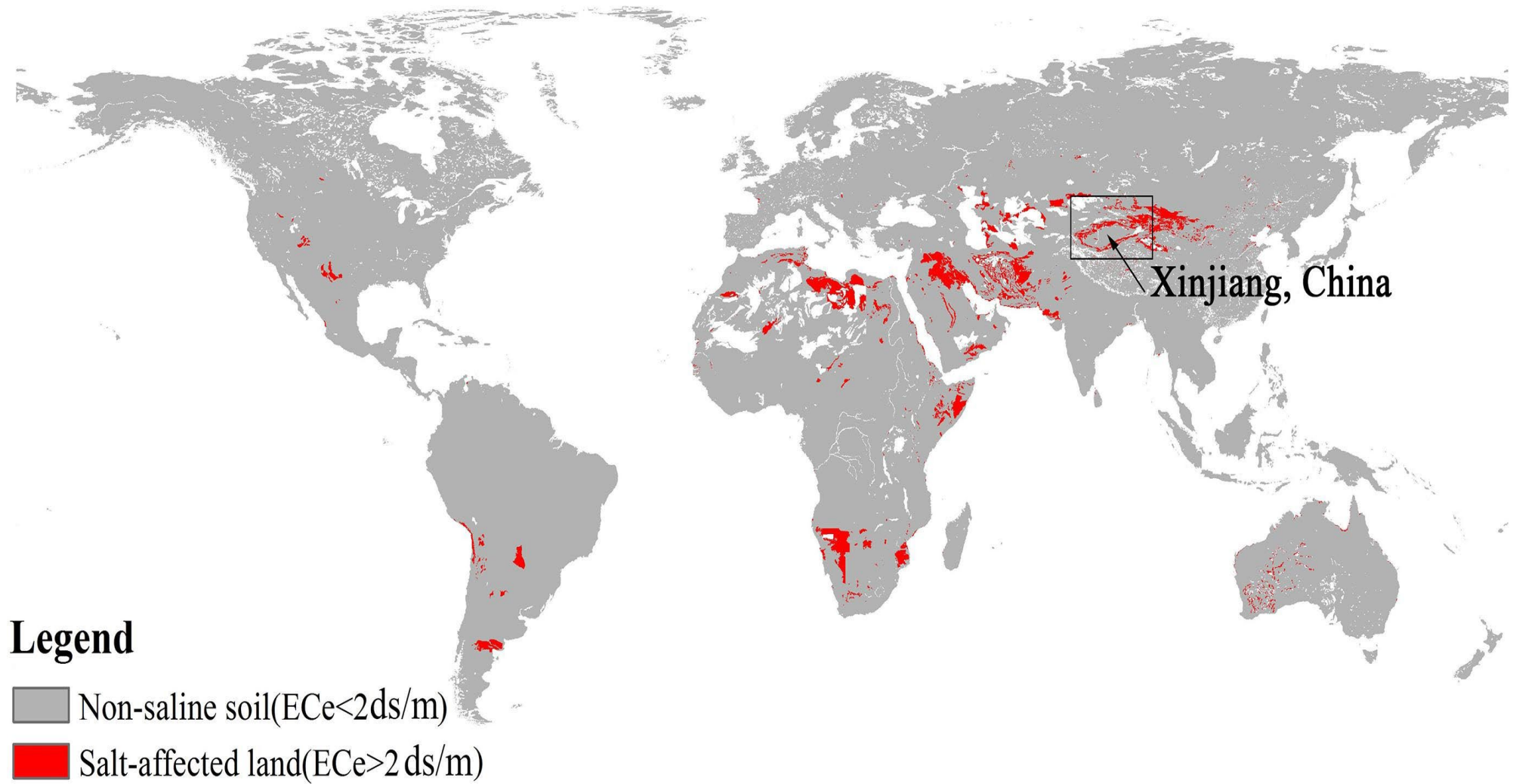
# ***BnaBBX22* enhances the salt tolerance of rapeseed by regulating ROS homeostasis**

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**State Key Laboratory of Crop Stress Biology for Arid Areas, NWAUFU**

# Research background



# Screening of salt-tolerant germplasm



**CK**

**75mM NaCHO<sub>3</sub> 15 day**

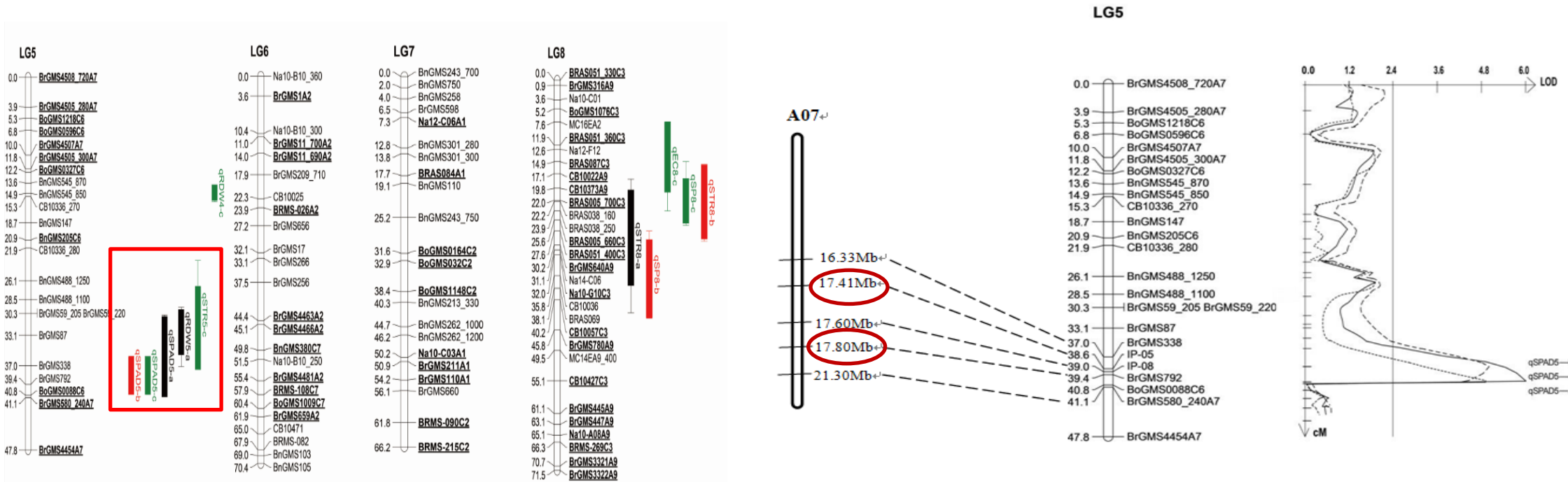


**2205**

**1423**

**200mM NaCl 10 day**

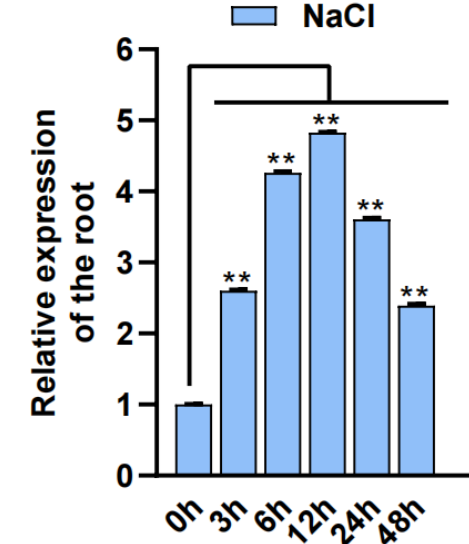
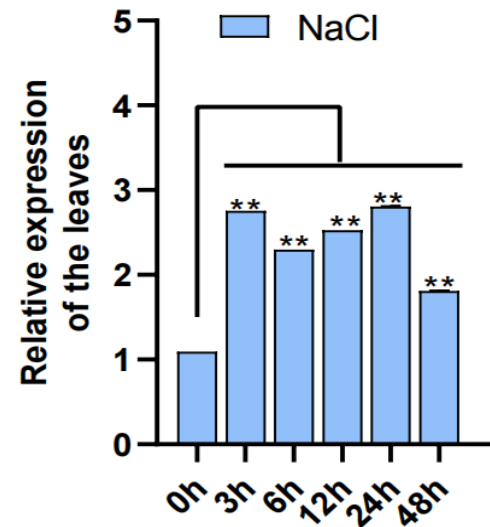
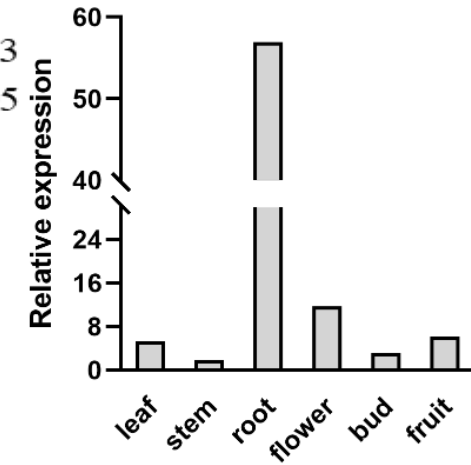
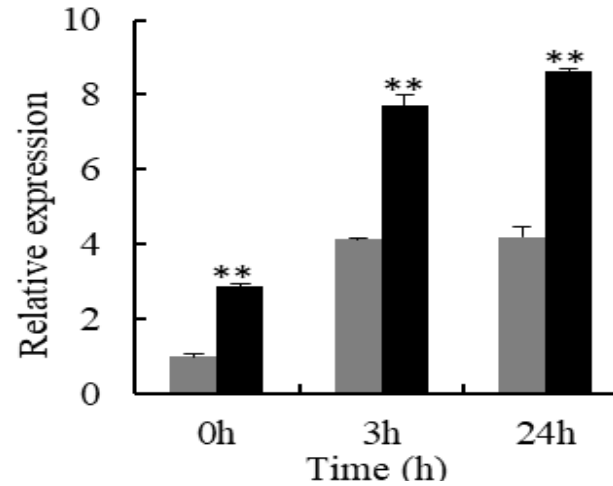
# QTL scanning of 269 F<sub>2:3</sub> populations for salt-tolerant traits



The dominant QTL *qSPAD5* (17.41-17.80 Mb) on chromosome A07 was detected by multiple salt-tolerant related traits, accounting for 35% of the phenotypic variation.

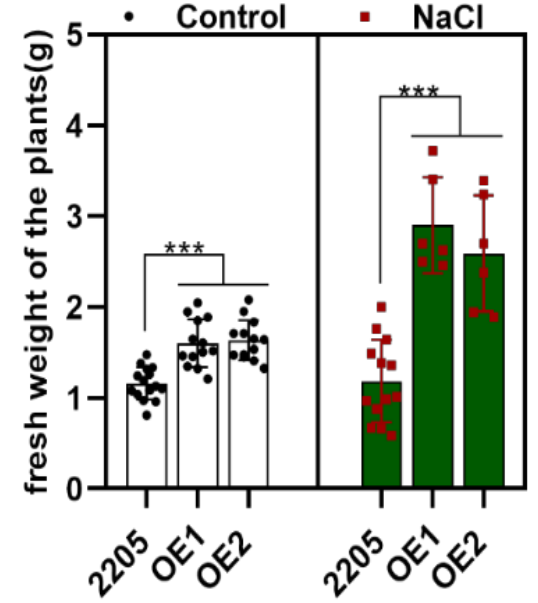
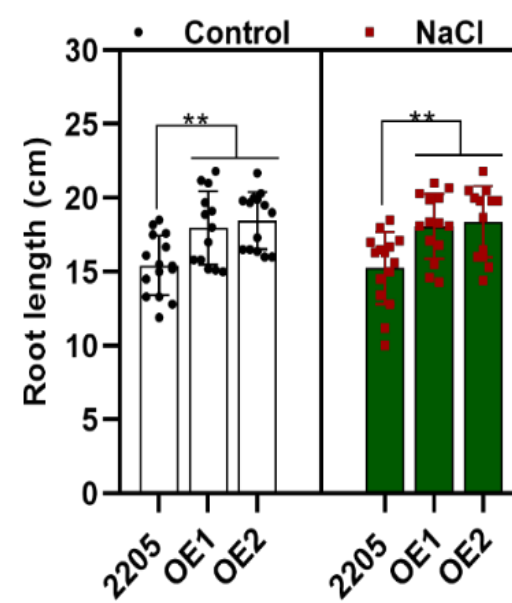
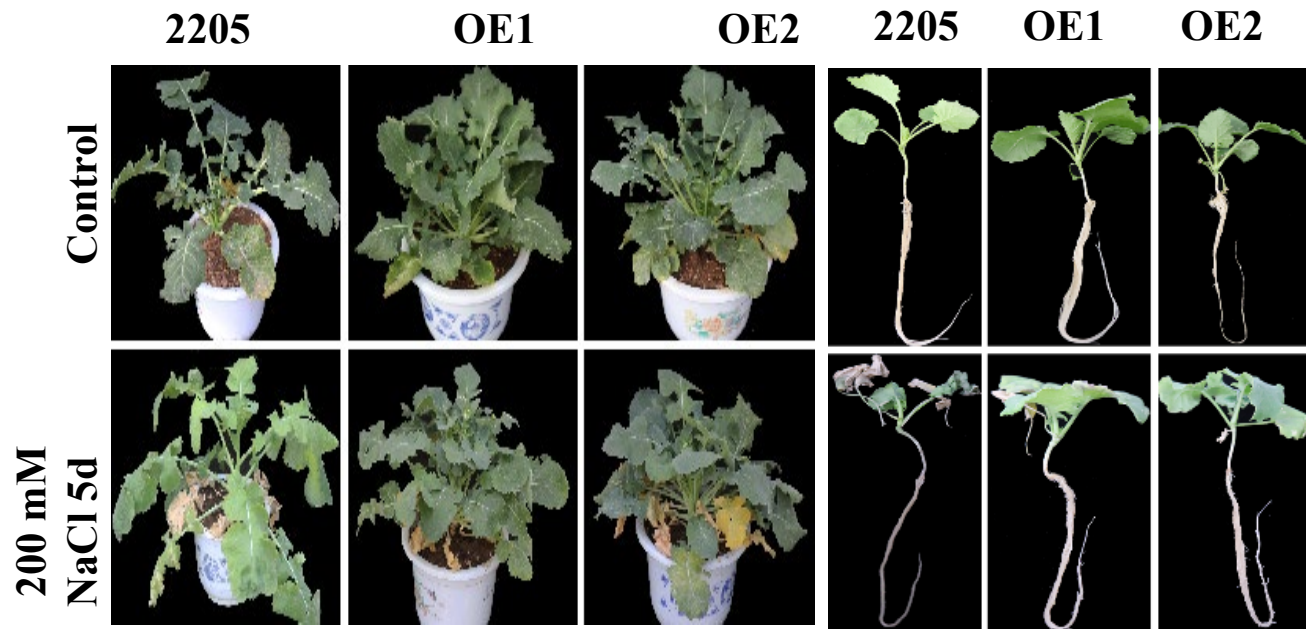
# Structure and expression analysis of BnaA07g...50D (*BnaBBX22*)

1423.txt	MKIQCNVCEAEAEVILCCADEAALGLACDERVHAANKLAG	40
2205.txt	MKIQCNVCEAEAEVILCCADEAALGWACDERVHAANKLAE	40
Atlg78600.txt	MKIQCNVCEAEAEVILCCADEAALGWACDERVHAANKLAG	40
Consensus	Δ Δ Δ Δ B-box1	
1423.txt	KHQRVPLSVSSSSPKCDICQEAAGFFFLQDRALLCRKC	80
2205.txt	KHQRVPLSVSSSSPKCDICQEAAGFFFLQDRALLCRKC	80
Atlg78600.txt	KHQRVPLSAASSPKCDICQEAAGFFFLQDRALLCRKC	80
Consensus	Δ Δ Δ Δ B-box2	
1423.txt	DVSIHTVNPVSAHQRFLLTGIRVGLSTTTDTGPSIFS..	118
2205.txt	DVSIHTVNPVSAHQRFLLTGIRVGLA..IDTGPSTKSSS	119
Atlg78600.txt	DVSIHTVNPVSAHQRFLLTGIRVGLS..IDTGPSTKSSP	119
Consensus	Δ Δ	
1423.txt	..NDDKINERK...PTSEPKMIFDHNHCVQ.....	146
2205.txt	PASNDDKAMETKQFTLPTSEPKMIFDEH..CVG.....	151
Atlg78600.txt	..NDDKIMETKPFVQSIPEPKMAFDHHECQQEQQEG	157
Consensus	nddk e k epqkm fd h q	
1423.txt	.LEETKVSDEHISTRLPEASSGSAATGSIFQWCIEEIFGLT	185
2205.txt	.LEETKVSDEHISTRLPEASSGSAATG...QWCLIEEIFGLT	186
Atlg78600.txt	VLEETKVNICTSTRLPELVSSGSTIG.SIFQWCIEEIFGLT	196
Consensus	p tkv d stklp ssgs qwq eifglt	
1423.txt	DFDQSYEYMENNGSS.....KADIS	205
2205.txt	DFDQSYEYMENNGSSS.....KADIS	207
Atlg78600.txt	DFDQSYEYMENNGSSKIDVLKMKLLDSACLGKLEKADIS	236
Consensus	dfdqsyeymennngss kadt	
1423.txt	RRGDSLSMMRSCEEDGEDNSNCLGGCETSWAVPQICSP	245
2205.txt	RRGDSLSMMRSCE.DGEDSSNCLGGCETSWAVPQIESP	245
Atlg78600.txt	RRGDSLSMMRSCEEDGEDNNSNCLGGCETSWAVPQICSP	275
Consensus	rrgdsd ssmrs e dged nclgg etswavpqi sp	
1423.txt	PTASGLNWERHSHHS.MFVFDISSALNTGSSPNQRVQK	284
2205.txt	PTASGLNWERHFNHSAVFPVDISSSTLYTGSSPNQRVQK	285
Atlg78600.txt	PTASGLNWERHSHHS.VFVFDISSSTPYTGSSPNQRVQK	314
Consensus	ptasglnwp h hhs fvpdi ss tgsspnqr gk	
1423.txt	RRR.	287
2205.txt	RRRR	289
Atlg78600.txt	RRRR	318
Consensus	rrr	



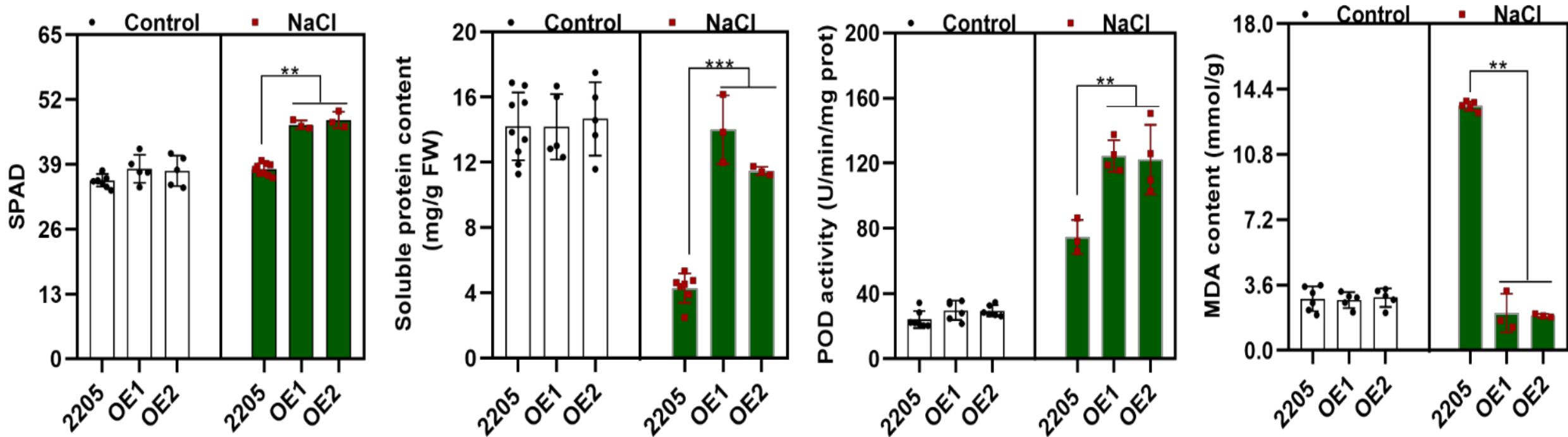
(Lang et al. 2017, Frontiers in plant science)

# Overexpression of *BnaBBX22* enhanced the salt tolerance of rapeseed



*BnBBX22* may positively mediate taproot elongation of rapeseed under NaCl stress and improve the salt tolerance.

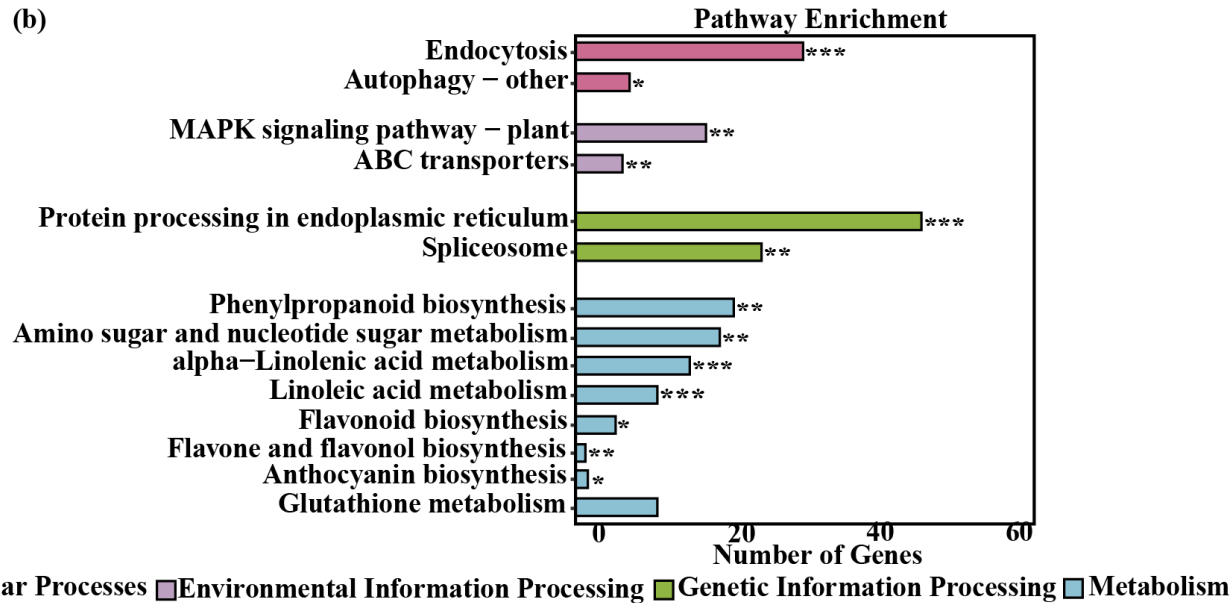
# Overexpression of *BnaBBX22* enhanced the salt tolerance of rapeseed



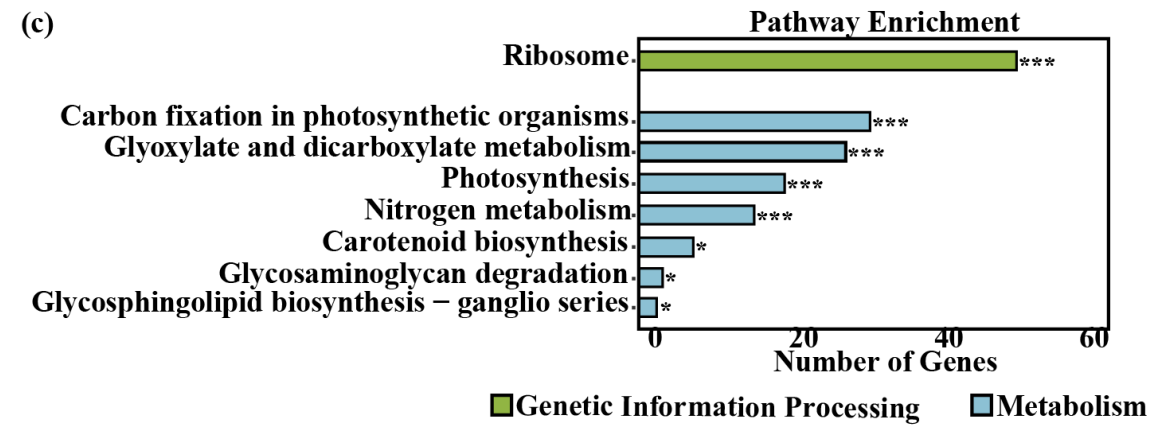
(unpublished)

# *BnaBBX22* mainly involved in the ROS and energy metabolism

## KEGG enrichment analysis of WT-6h vs. OE-6h up-regulated DEGs



## KEGG enrichment analysis of WT-6h vs. OE-6h down-regulated DEGs

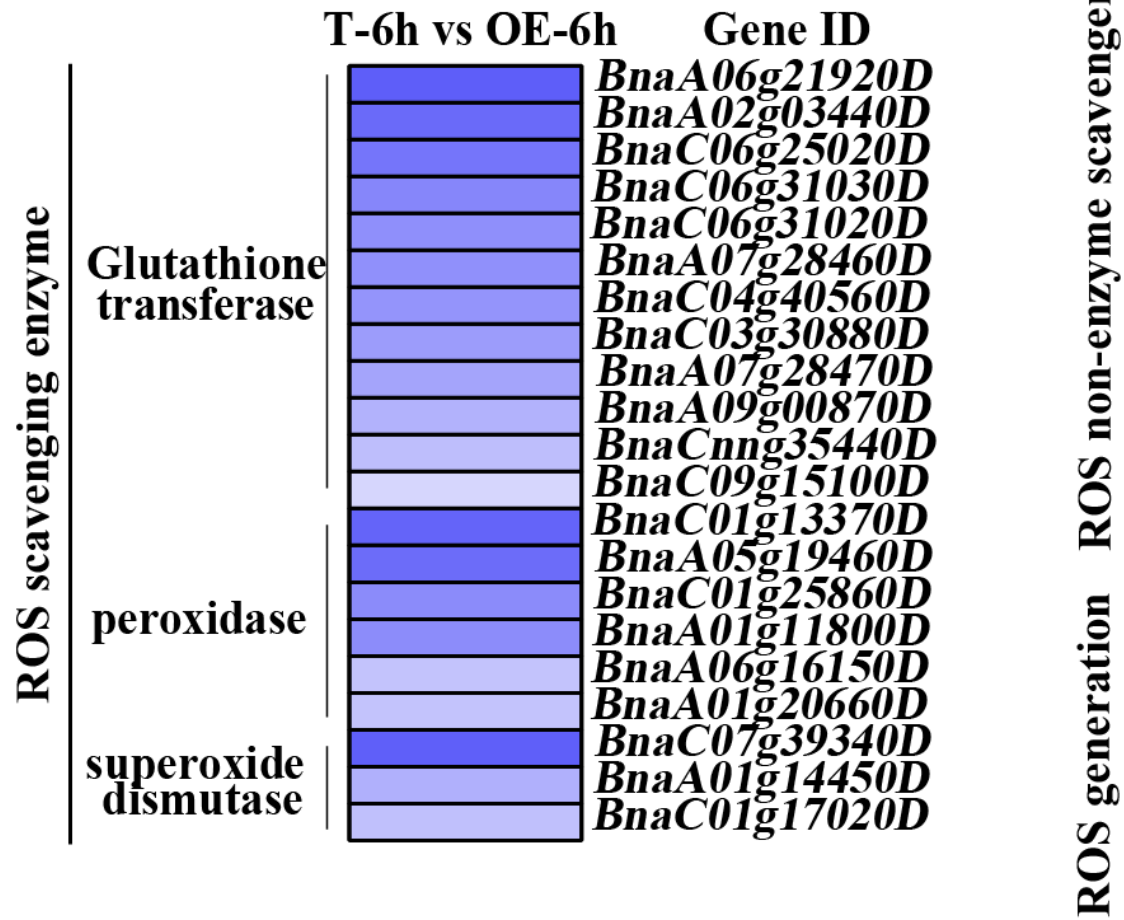


The up regulated DEGs were mainly enriched in active oxygen metabolism.

Down-regulated DEGs were mainly concentrated in energy metabolic pathways.

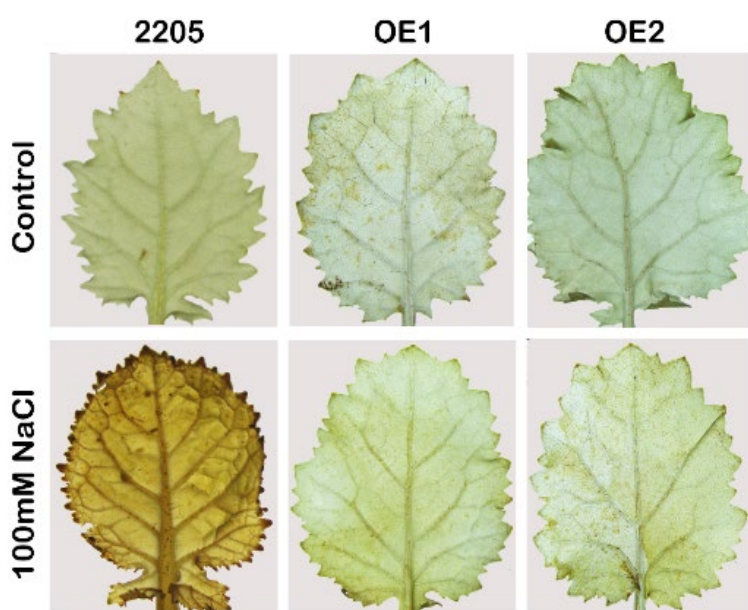
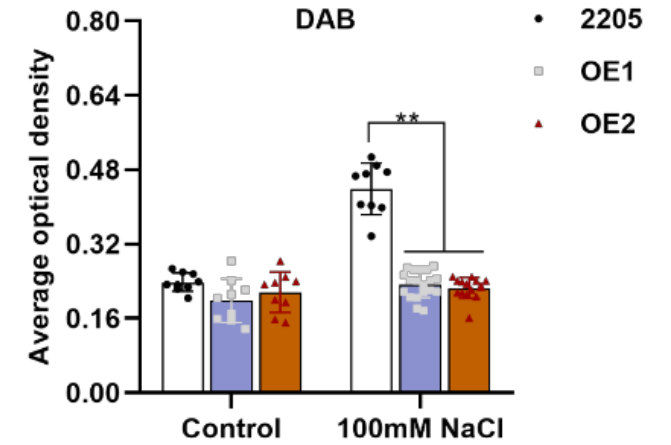
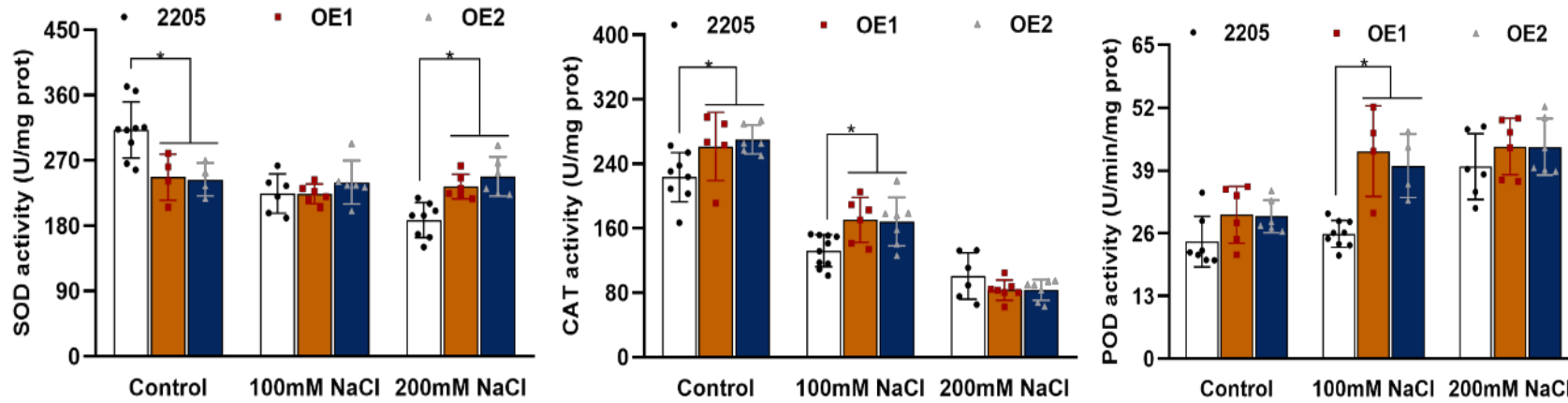
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# *BnaBBX22* affects the expression of ROS related genes under salt stress

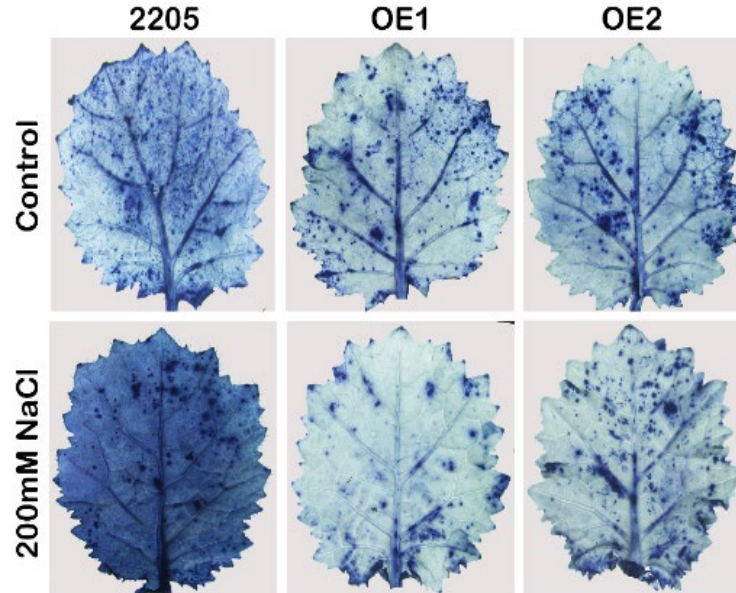


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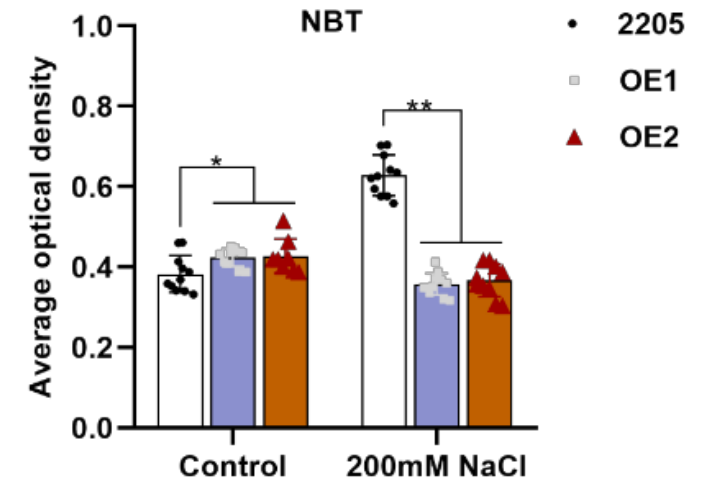
# *BnaBBX22* reduces the accumulation of ROS in rapeseed under salt stress



DAB stain

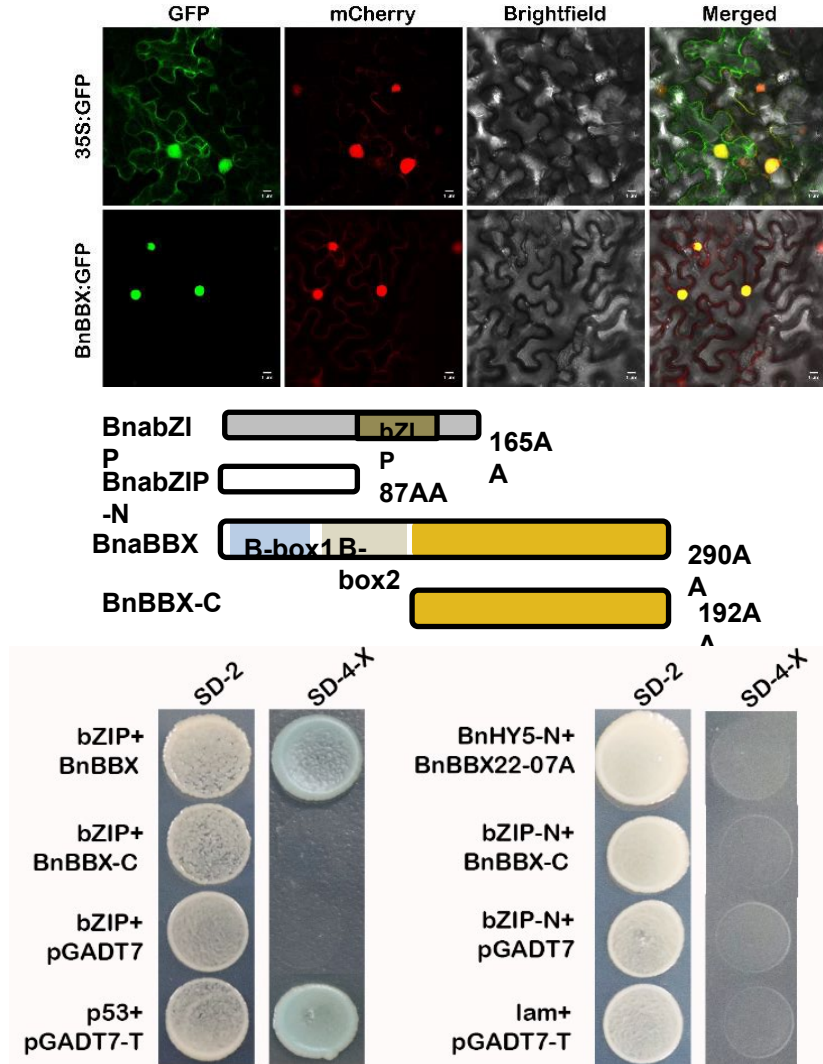


NBT stain

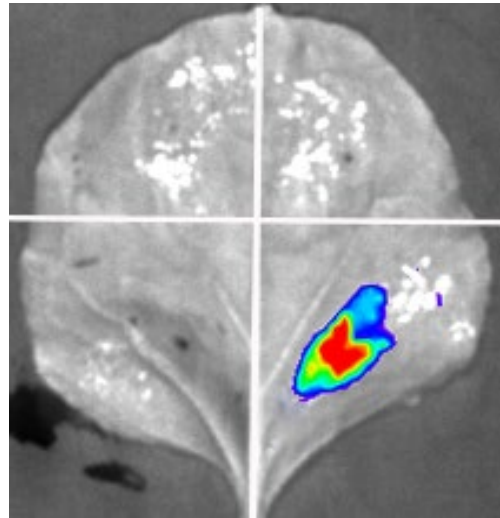
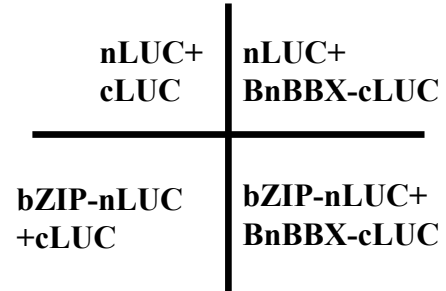


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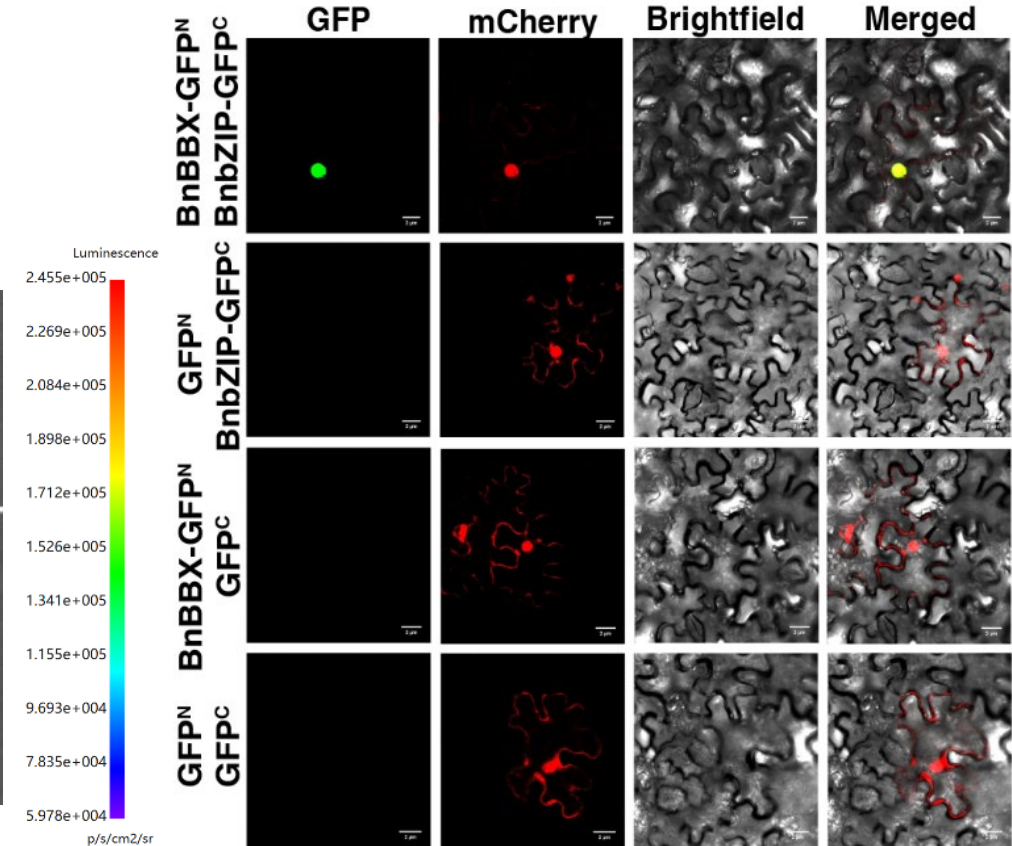
# BnaBBX22 interacts with BnabZIP



## LCI

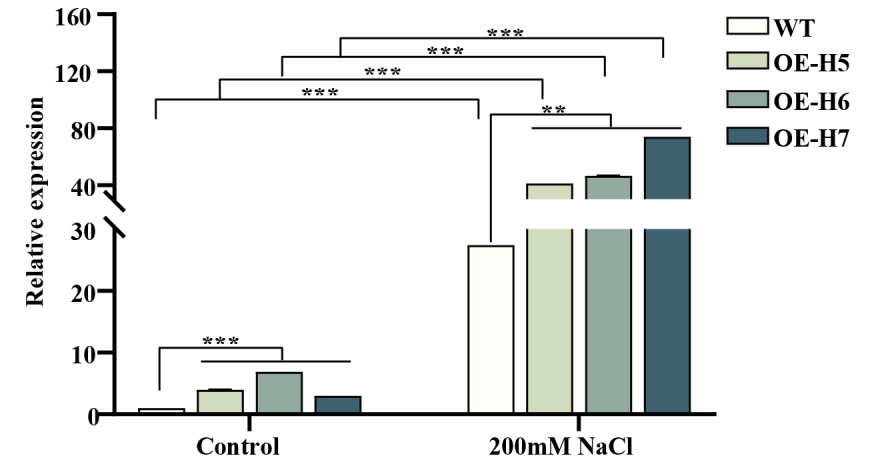
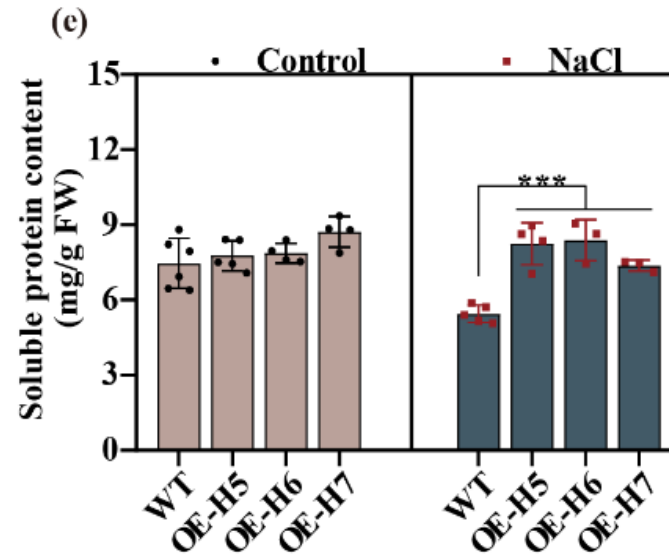
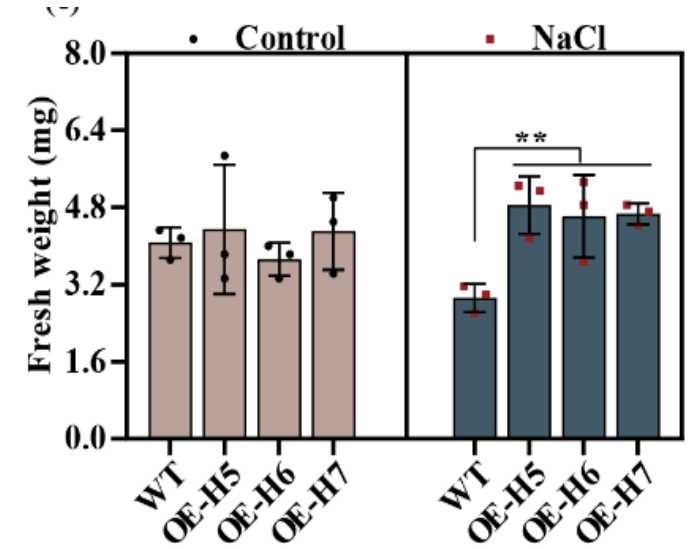
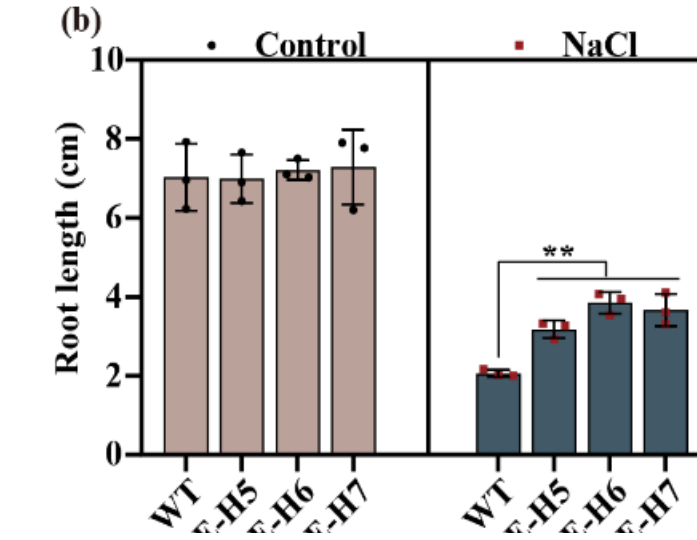
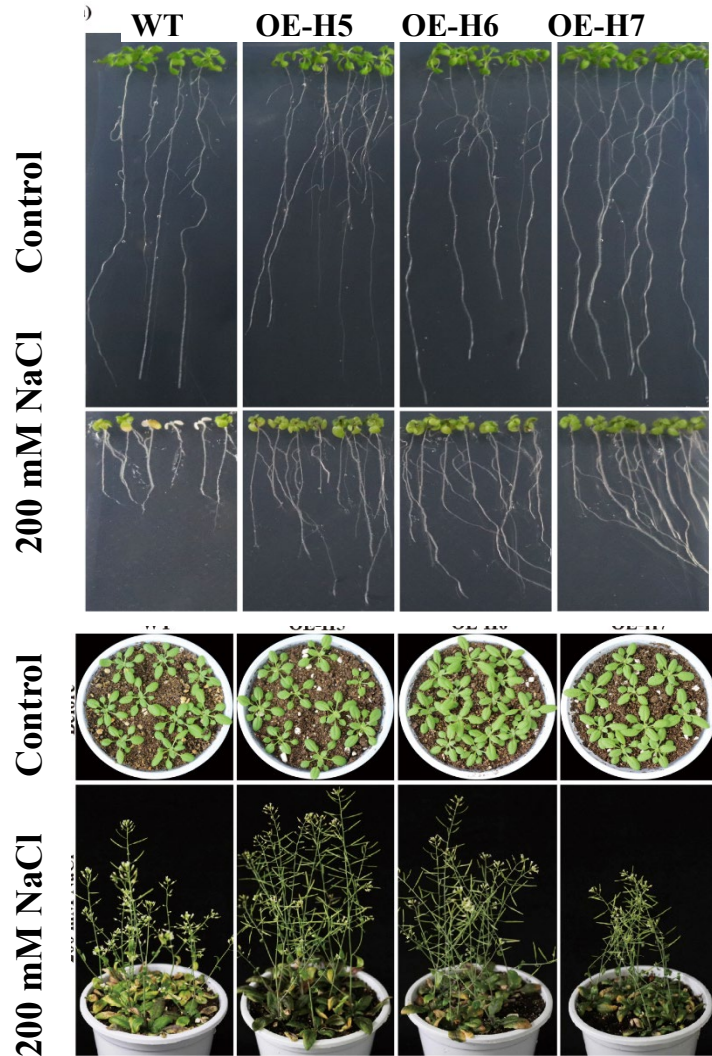


## BiFC



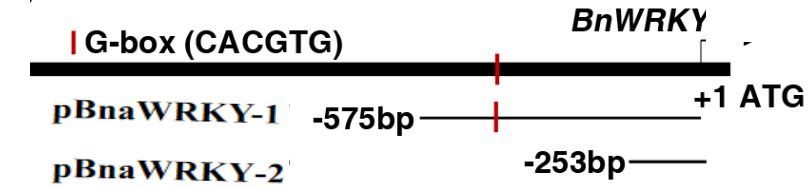
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# Overexpression of *BnabZIP* enhanced the salt tolerance of Arabidopsis



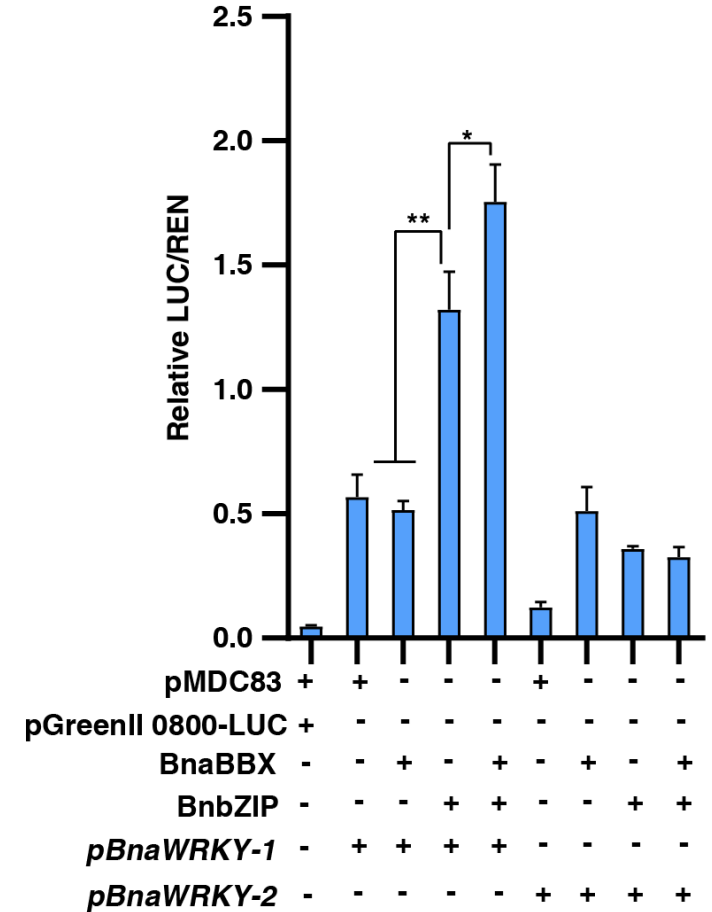
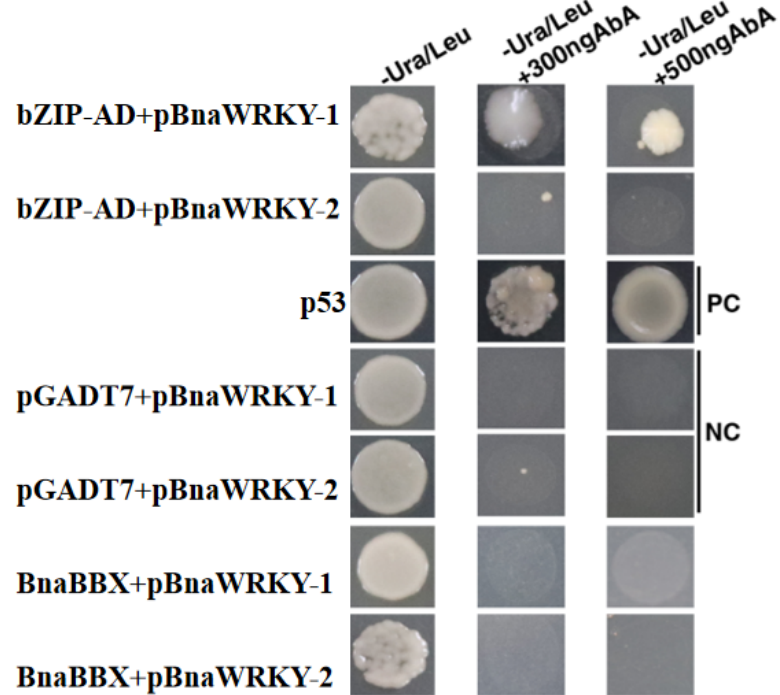
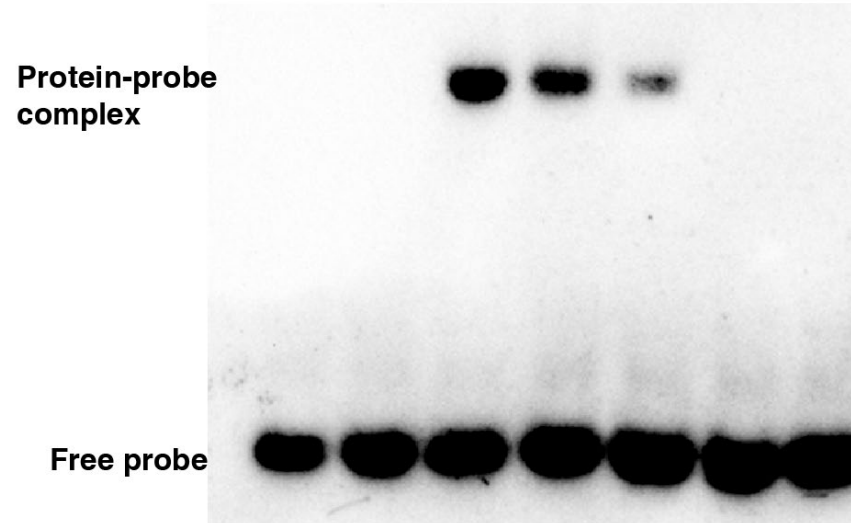
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# BnabZIP interacts with *BnaWRKY* and activates its expression



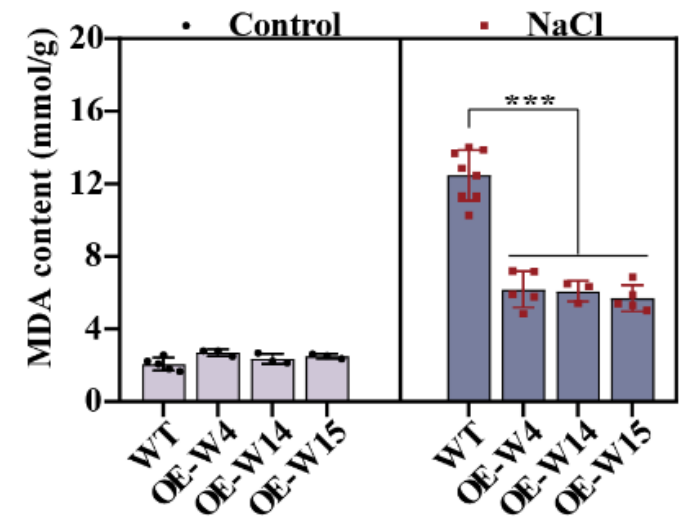
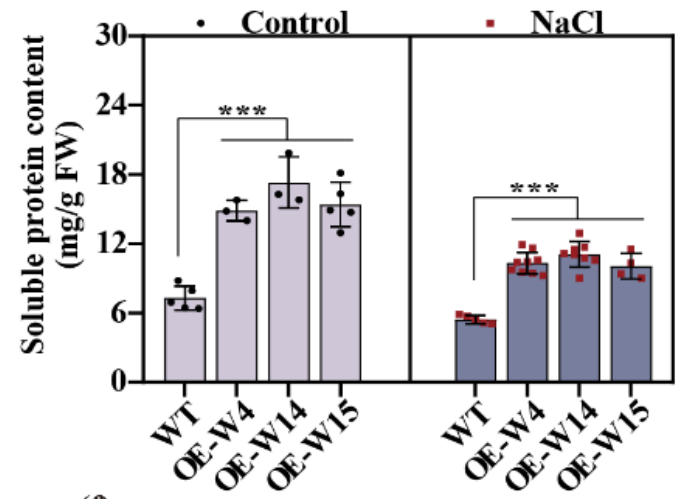
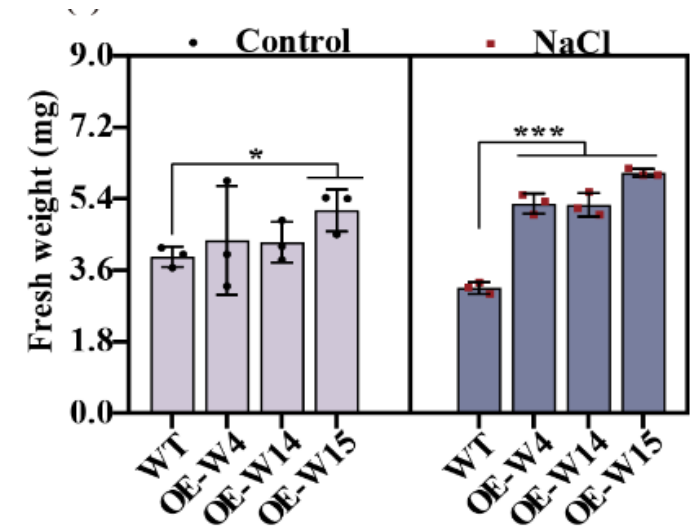
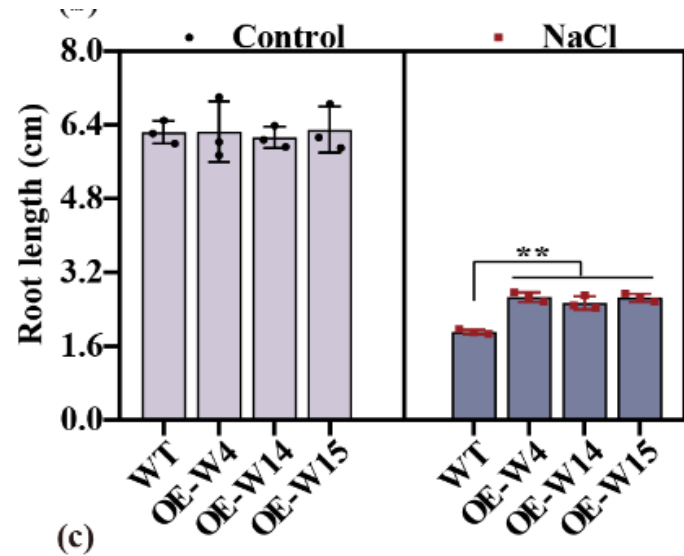
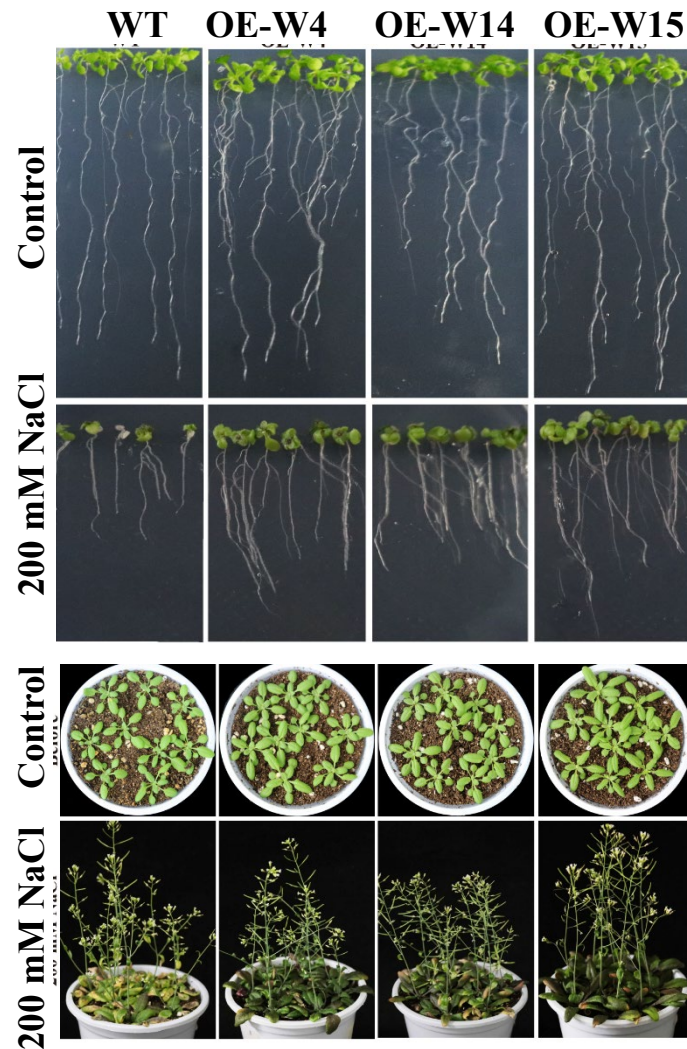
G-box-WT TAAATCA **CACGTG** GCAGTTA  
 G-box-Mutant TAAATCA **CTTTG** GCAGTTA

Probe	+	+	+	+	+	-
Competitor probe	-	-	5x	20x	50x	-
Mutant probe	-	-	-	-	-	+
MBP	+	-	-	-	-	-
MBP-BnbZIP	-	+	+	+	+	+



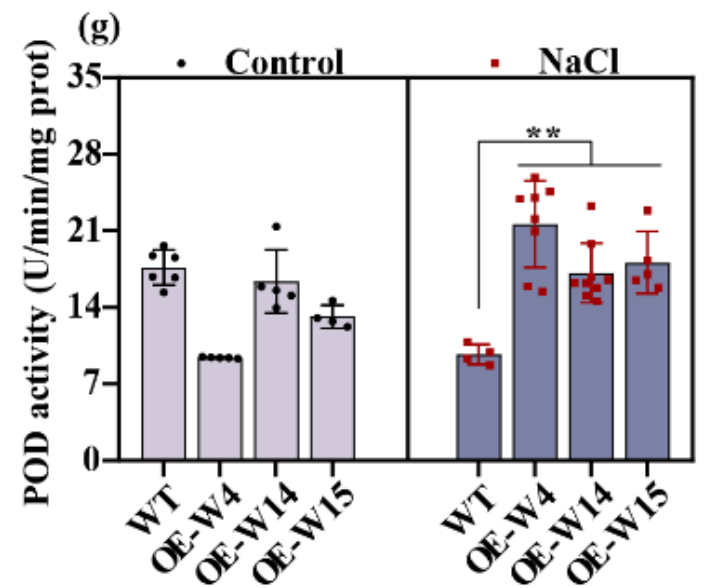
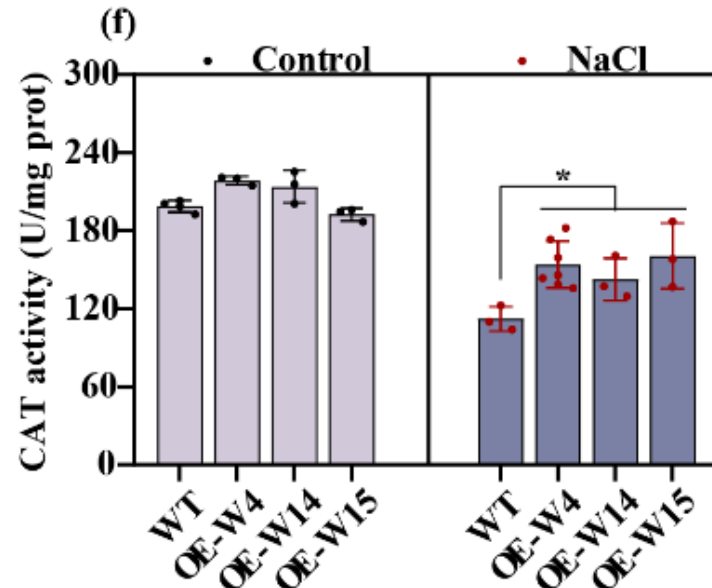
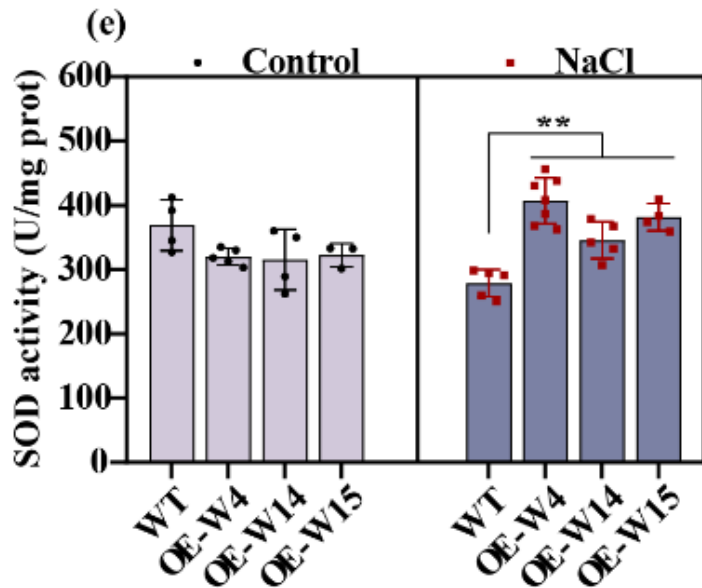
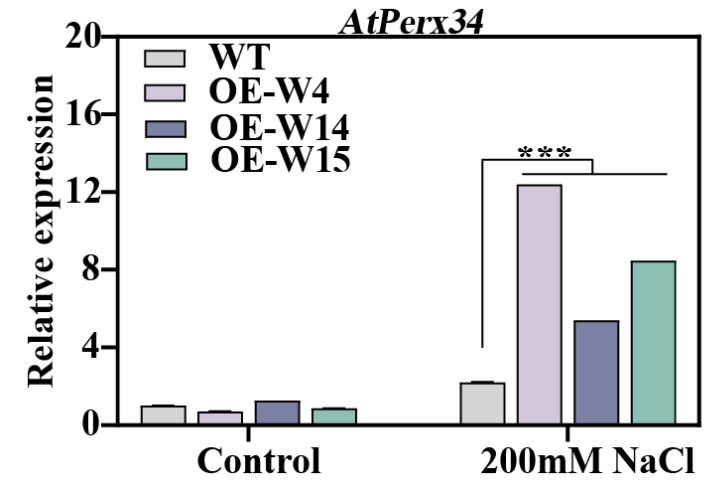
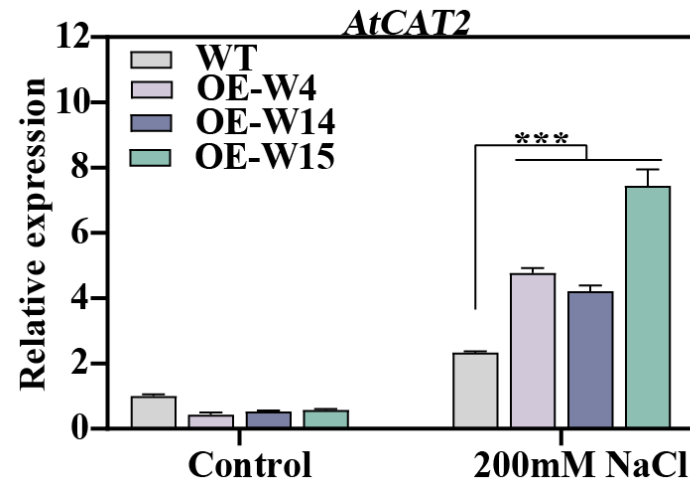
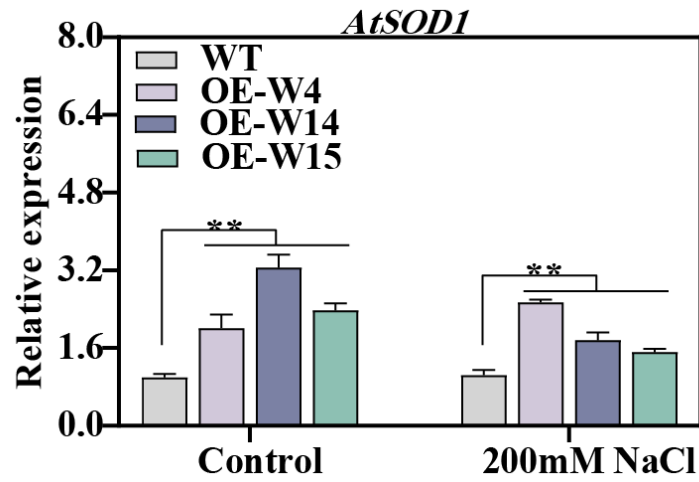
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# *BnaWRKY* positively regulates the salt tolerance of Arabidopsis



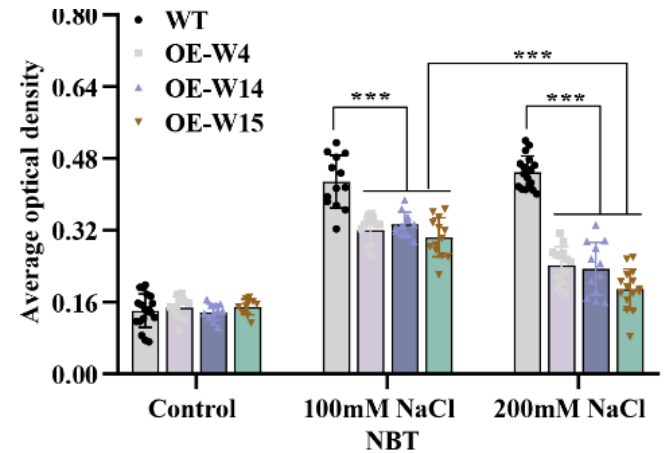
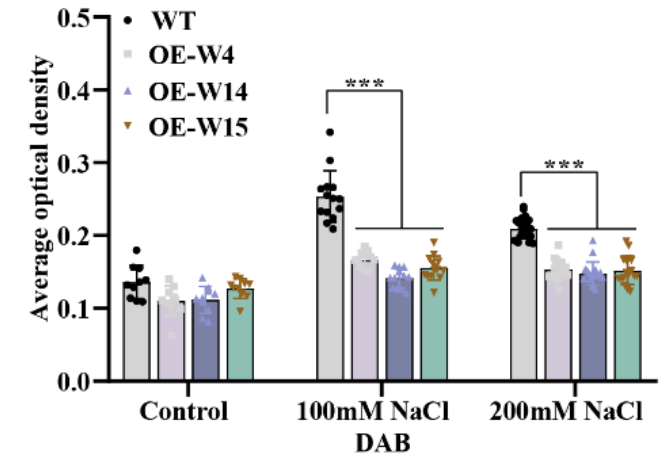
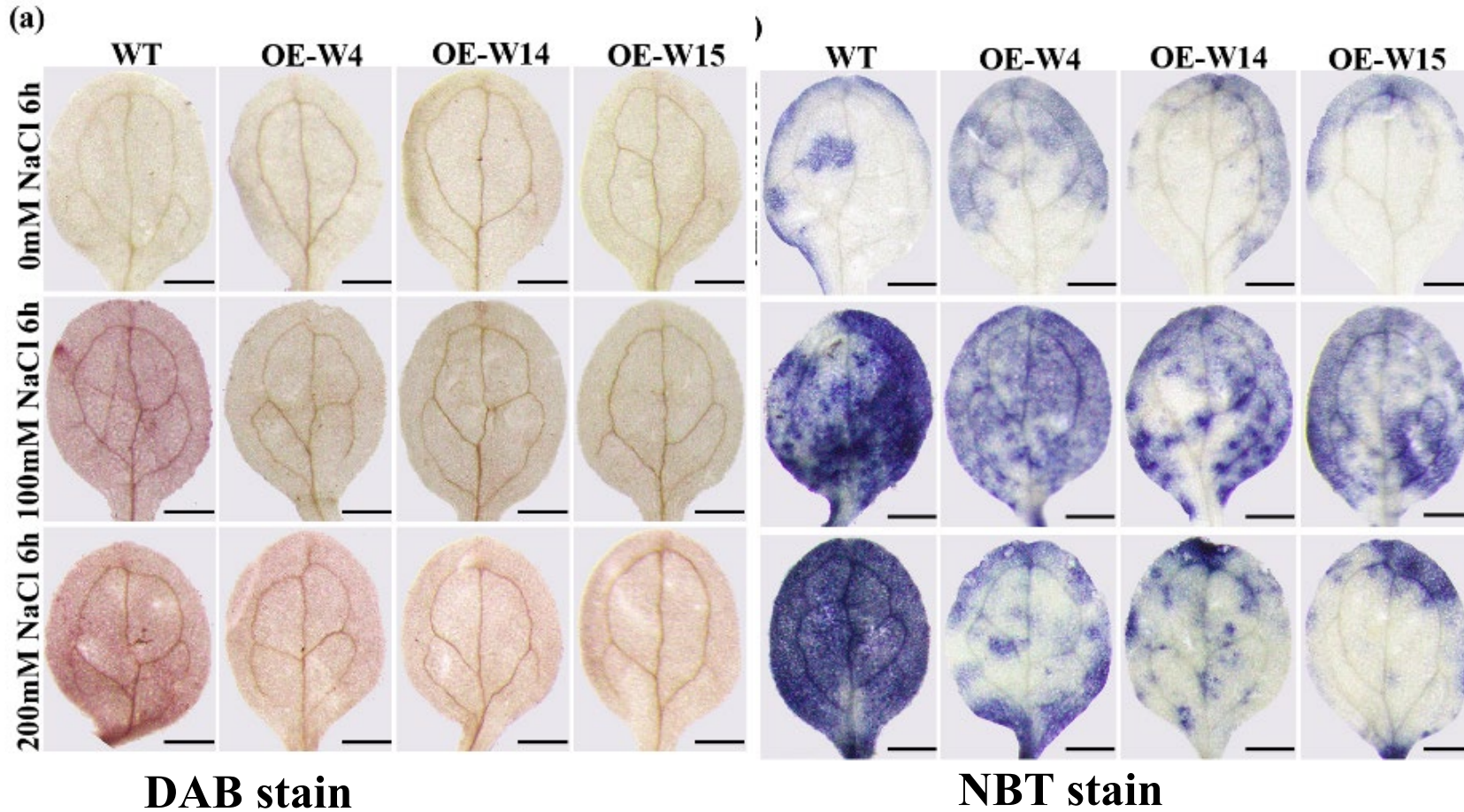
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# *BnaWRKY* enhances the activity of ROS scavenging enzyme under salt stress



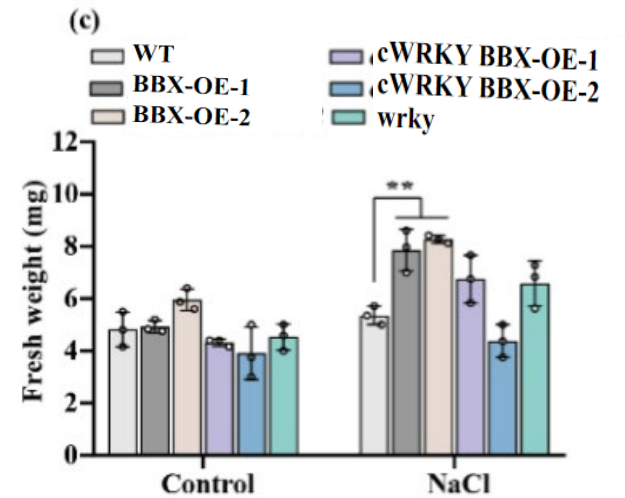
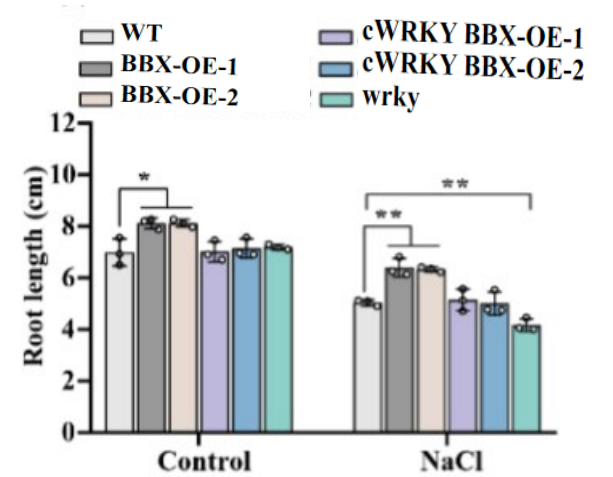
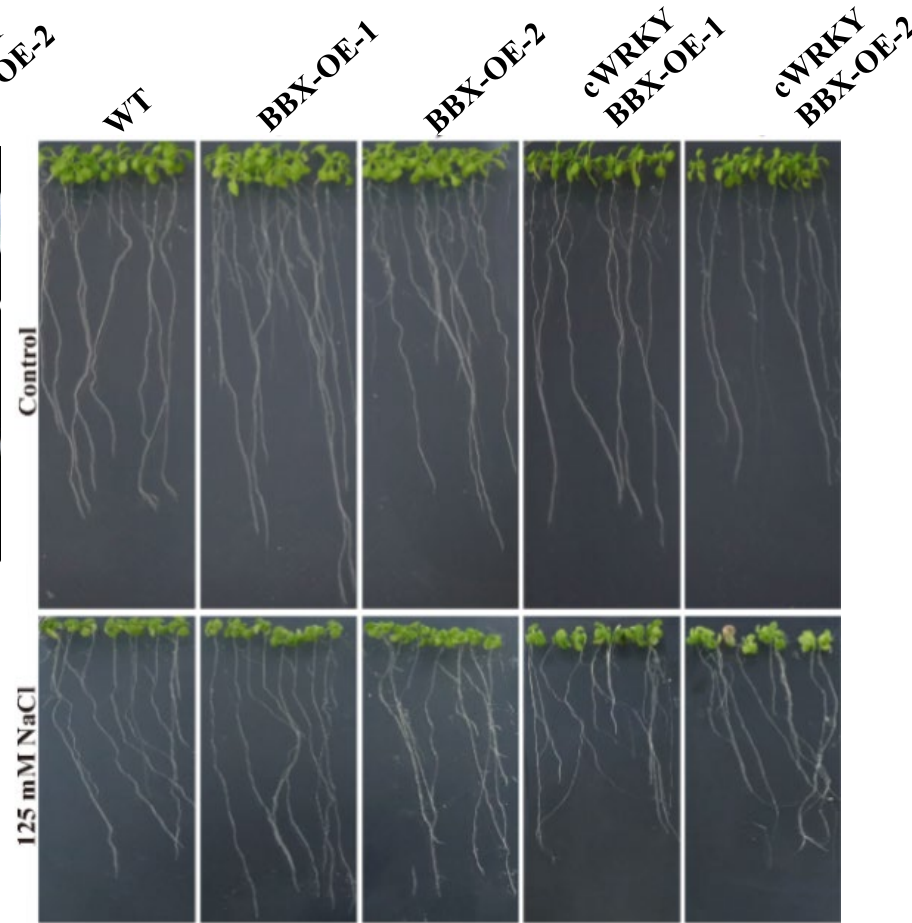
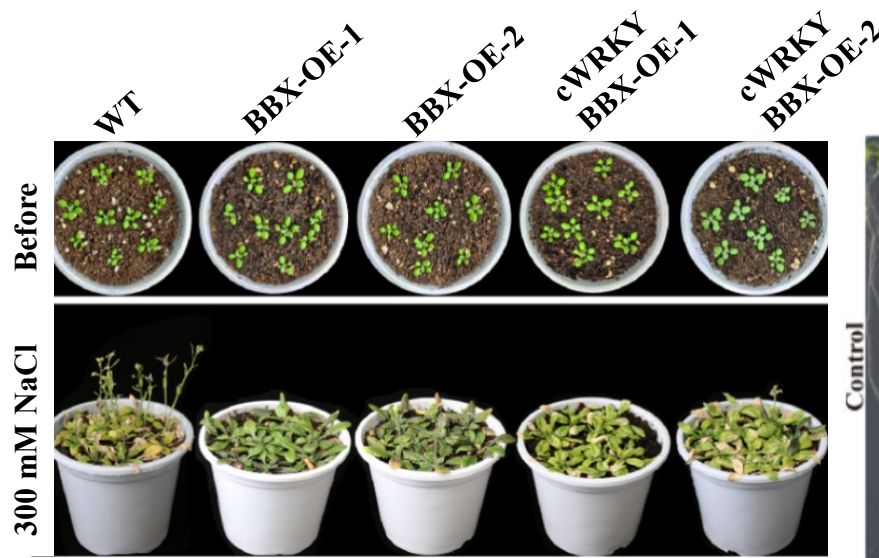
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# *BnaWRKY* decreases the accumulation of ROS in Arabidopsis under salt stress



(unpublished)

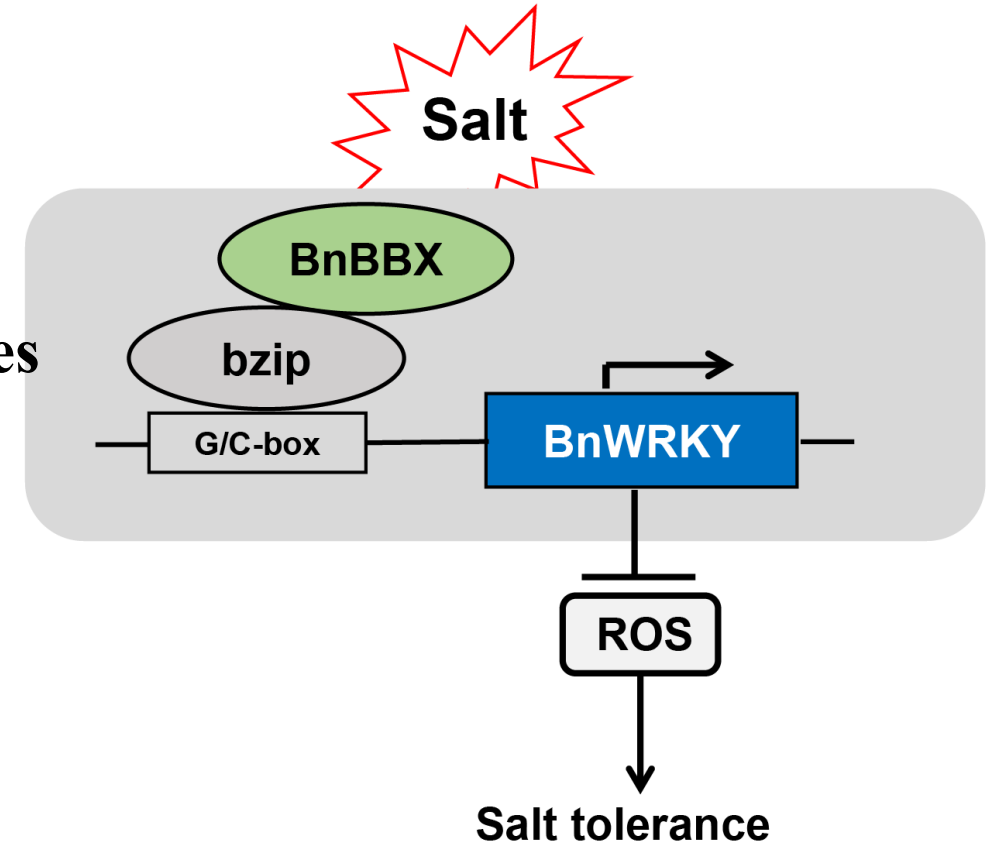
# The salt tolerance of overexpression *BnaBBX22* lines with *WRKY* knocked out was significantly reduced



(unpublished)

# BnaBBX22-BnabZIP-*BnaWRKY* module regulates salt tolerance in rapeseed

- Under NaCl stress, the expression of *BnaBBX22* was up-regulated.
- *BnaBBX22* interacts with BnabZIP, and activates the expression of *BnaWRKY*.
- Then *BnaWRKY* regulates the ROS homeostasis in plants by regulating the expression and activity of genes related to ROS scavenging .
- Thereby enhance the salt tolerance of rapeseed.



(unpublished)

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- Aldiyar
- Haodong Li
- Juan Ding



**Thank for your attention!**

