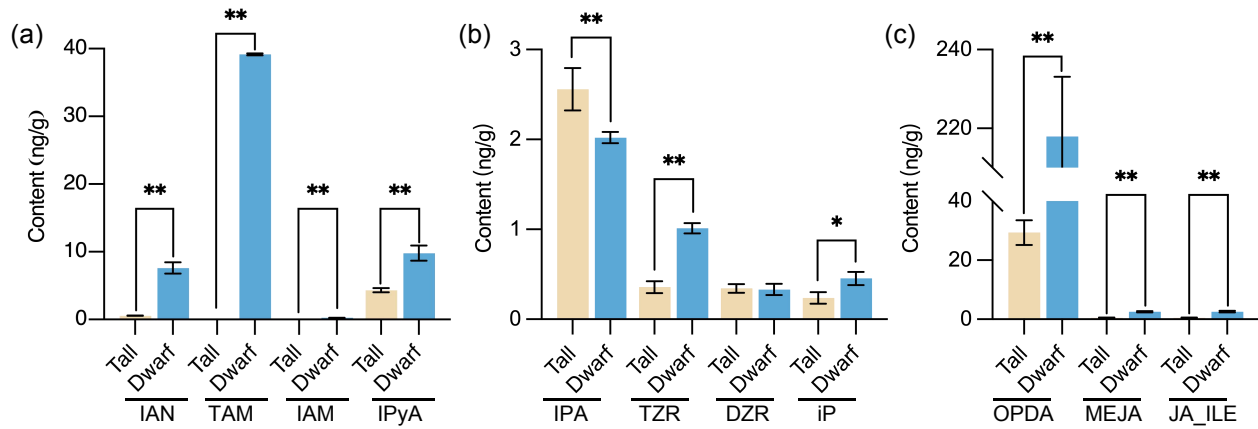


**Fig S1** Statistical analysis of internode lengths of *Rht5* RILs

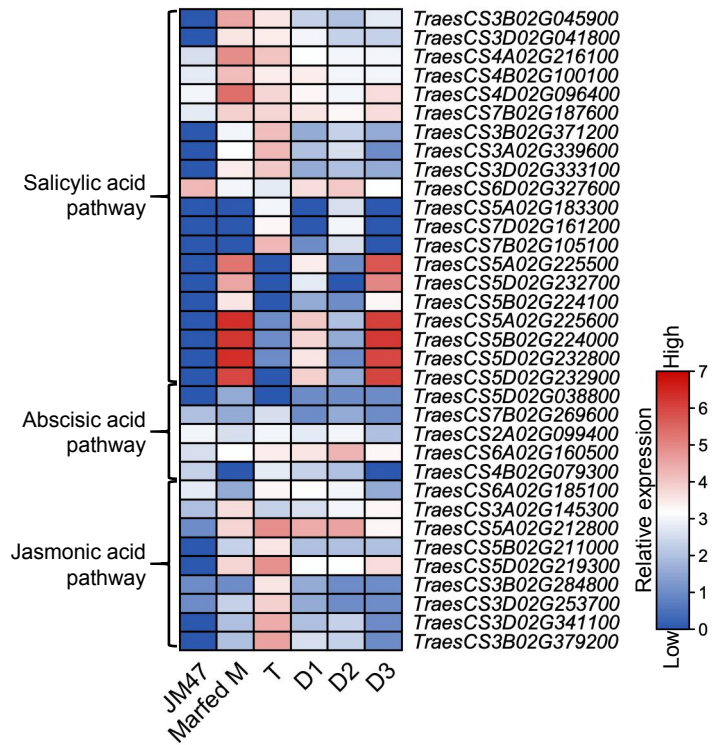
Internodes from bottom to top were designated sequentially as the fifth, fourth, third, and second internodes (I5, I4, I3, and I2), followed by the peduncle (the uppermost internode directly below the spike) and spike. Data are presented as means  $\pm$  SD ( $n = 8$ ).



**Fig S2** Measurement of endogenous phytohormone precursors in *Rht5* RILs

(a–c) Contents of endogenous auxin precursors (a), cytokinin precursors (b) and jasmonic acid precursors (c) in *Rht5* RILs.

Data are presented as means  $\pm$  SD ( $n = 3$ ). \* $P < 0.05$ , \*\* $P < 0.01$ , ns, not significant. Student's  $t$  test.



**Fig S3** Heatmap showing TPM values of stress-related phytohormone pathways. TPM (transcripts per million) values of DEGs were used for heatmap analysis. T indicates the tall *Rht5* RILs. D1, D2 and D3 indicates three independent dwarf RILs.

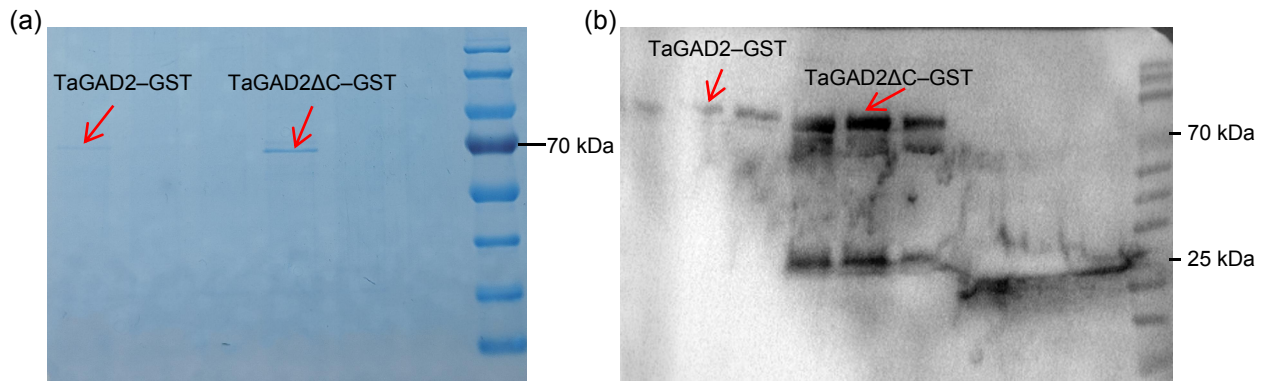
Glutamate decarboxylase (16 – 445 AAs)

TaGAD2	MVVTVAATG - SDTAEPLHSTTFASRYVRDQLPRYRMPEGSIPKEAAYQIISDELMLDGNP	59
GmGAD5	MVLTSTATHPDEKDDSLNS - TFASRYVRDPIPKFKMPEKSI PKDAAFQIINDELMLDGA	59
OsGAD1	MVLSHASSG - RDDAV - - RCTFAITRYACETLPRFRMPEQSIPKEAAYQIINDELMLDGNP	56
ZmGAD1	MALSTTNTN - - AAESQLHCS - TFASRYVRTALPRFKIPEQSIPKEAAYQIINDELMLDGNP	58
AtGAD1	MVLSHAVS - - ESDVSVHS - TFASRYVRTSLPRFKMPENSI PKEAAYQIINDELMLDGNP	56
TaGAD2	RLNLA SFVTTWMEPECGKLI MDSV NKNYVDMDEYPTTELQNRVCNMIAHLFNAP I G E D E	119
GmGAD5	RLNLA SFVTTWMEPECDKLI M A S L NKNYVDMDEYPTTELQNRVCN I I A N L F H A P I S E E E	119
OsGAD1	RLNLA SFVTTWMEPECDKLI M D S V NKNYVDMDEYPTTELQNRVCNMIAHLFNAP I K E D E	116
ZmGAD1	RLNLA SFVTTWMEPECDKLI Q S S I NKNYVDMDEYPTTELQNRVCNMIAHLFNAP I G D D E	118
AtGAD1	RLNLA SFVTTWMEPECDKLI M S S I NKNYVDMDEYPTTELQNRVCNMIAHLFNAP L E A E	116
TaGAD2	TAIGVSTVGSSEA IMLAGLAFKRKWKANKMK EQGKPCDKPNI VTGANVQVCWEKFARYFEV	179
GmGAD5	TAVGVGTVGSSEA IMLAGLAFKRKWKTRKRK AEGKPYDKPNI VTGANVQVCWEKFARYFEV	179
OsGAD1	TAIGVGTVGSSEA IMLAGLAFKRKWKQNKRK EQGKPCDKPNI VTGANVQVCWEKFARYFEV	176
ZmGAD1	TAVGVGTVGSSEA IMLAGLAFKRKWKQNKMK AAGKPYDKPNI VTGANVQVCWEKFARYFEV	178
AtGAD1	TAVGVGTVGSSEA IMLAGLAFKRKWKQNKRK AEGKPVDKPNI VTGANVQVCWEKFARYFEV	176
TaGAD2	ELKEVKL TEGYYVMDPKKAI EMVDENTICVAAI LGSTL TGEYEDVKLLN D L L V E K N K K T G	239
GmGAD5	ELKEVKL KEGYYVMDPAKAV EMVDENTICVAAI LGSTL M T G E F E D V K L L N E L L T E K N K E T G	239
OsGAD1	ELKEVKL S E G Y Y V M D P V K A V E M V D E N T I C V A A I L G S T L T G E F E D V K L L N L L T E K N K E T G	236
ZmGAD1	ELKEVKL KEGYYVMDPEKA AEMVDENTICVAAI LGSTL N G E F E D V K L L S D L L T A K N A E T G	238
AtGAD1	ELKEVKL S E G Y Y V M D P Q Q A V D M V D E N T I C V A A I L G S T L N G E F E D V K L L N D L L V E K N K E T G	236
TaGAD2	WNVPIHVDAASGGFIAPFLQPELEWDFRLPLVKSINVS GHKYGLVYPGVGWVIWR SKDDL	299
GmGAD5	WDTP IHVDAASGGFIAPFLY P D L E W D F R L P L V K S I N V S G H K Y G L V Y P G V G W V I W R S K D D L	299
OsGAD1	WDVP IHVDAASGGFIAPFLYPELEWDFRLPLVKSINVS GHKYGLVYPGVGWVIWR SKEDL	296
ZmGAD1	WDTP IHVDAASGGFIAPFLYPELEWDFRLPLVKSINVS GHKYGLVYAGVGVVIWR SKEDL	298
AtGAD1	WDTP IHVDAASGGFIAPFLYPELEWDFRLPLVKSINVS GHKYGLVYAGTGWVIWR N K E D L	296
TaGAD2	PDELIFHINYLGT DQPTFTLNF SKGASQIIAQYYQLIRLGFEGYKHI M E N C K L N A A V L K E	359
GmGAD5	PDEL V F H I N Y L G S D Q P T F T L N F S K G S S Q I I A Q Y Y Q L I R L G F E G Y K N I M E N C L E N A R V L K E	359
OsGAD1	PEELIFHINYLGT DQPTFTLNF SKGSSQIIAQYYQLIRLGFEGYKNI M Q N C M E N T A I L R E	356
ZmGAD1	PDELIFHINYLGA DQPTFTLNF SKGSSQIIAQYYQLIRLGFEGYKDV M Q N C R D N A A V L R E	358
AtGAD1	PEELIFHINYLGA DQPTFTLNF SKGSSQVI AQYYQLIRLGH EGYRNV M E N C R E N M I V L R E	356
TaGAD2	GIDATGRFDVLSKADGVPLVAIRLKDSTNFSVFDI ISENLRFRFGWIVPAYTMPADA EHVAV	419
GmGAD5	GIER TGRFNII SKDIGVPLVAFSLKDS SQH TVFEI ADHLRKF G W I V P A Y T M P P D A Q H I A V	419
OsGAD1	GIEATGRFEILSK EAGVPLVAFSLKDSGRY TVFDI ISELRFRFGWIVPAYTMPANA EHVAV	416
ZmGAD1	GINKMGYFDVLSKDSGVPLVAFSLKDS SKY TVFEVAESLRFRFGWIVPAYTMPADA EHVAV	418
AtGAD1	GLEKTE R F N I V S K D E G V P L V A F S L K D S S C H T E F E I I S D M L R R Y G W I V P A Y T M P P N A Q H I T V	416
TaGAD2	LRVVIREDFNRSLAQRL LADINKIVRELD AHAVHAIKLS - - NAAAAEG - - - - - ASKS	469
GmGAD5	LRVVIREDFSRGLAERLAADI EKVVKLLD TLPSPLTTKVAHI TAITSETS - - - - - EKVKKS	474
OsGAD1	LRVVIREDFSRSLAERLVS DIVKILH ELD AHS A Q V L K I S - - - S A I A K Q Q S G D D G V V T K K S	473
ZmGAD1	MRVVIREDFSRGLAERL IADLGK T M A D M D A H A G R - - - - - K Q A P E Q P - - - - - K K S	462
AtGAD1	LRVVIREDFSRTL AERLVI D I E K V M R E L D E L P S R V I H K I S L G Q E K S E S N S D N L M V T V K K S	476
TaGAD2	TVDAVTEAFK - - - GLAGN - - - KKA GVC	490
GmGAD5	AIETQKEI ALYW KRLVDG - - - KRLGAC	498
OsGAD1	VLETERE I FAYWRDQVKK - - - KQTGIC	497
ZmGAD1	VHDIEK E V T T F W R R L V A N S K K K S M V C	489
AtGAD1	DIDKQRDIITGW KKFVAD - RKKTS GIC	502

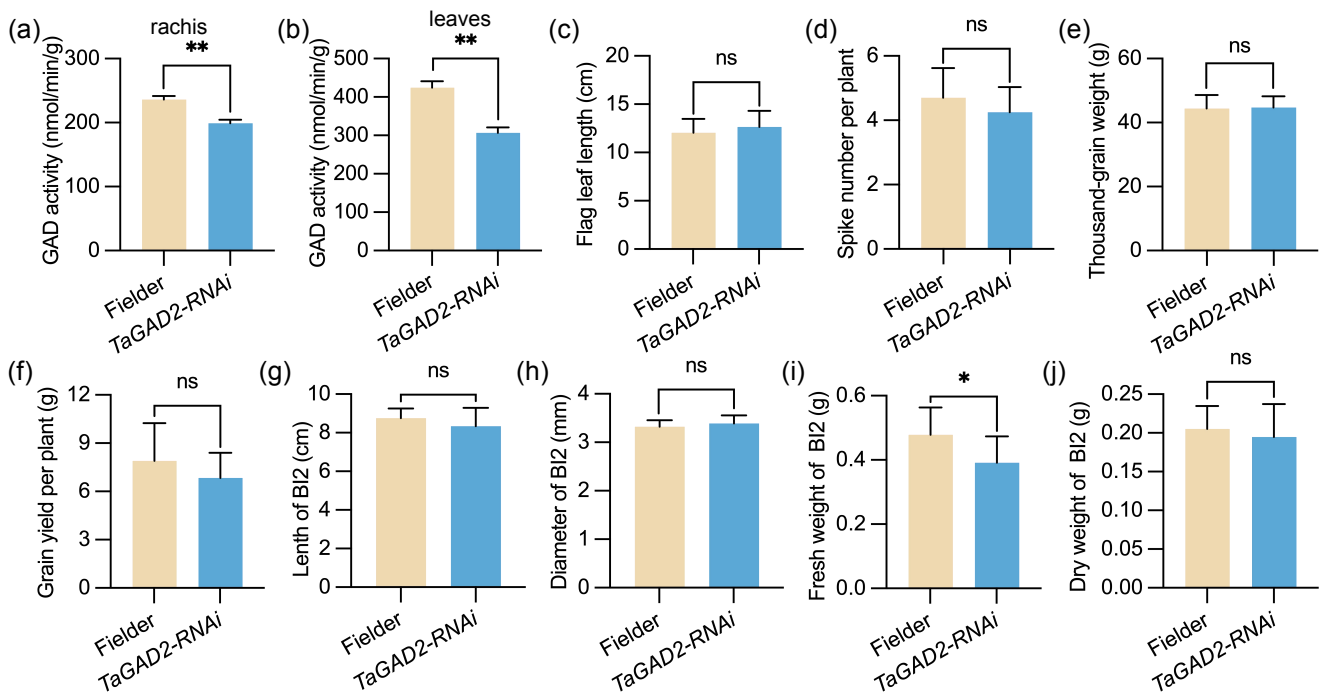
C-terminal auto-inhibitory domain (AID) (460 – 490 AAs)

**Fig S4** Multiple sequence alignment of glutamate decarboxylase (GAD) proteins across plant species

Conserved functional motif of GAD are highlighted in red, and the C-terminal auto-inhibitory domain (AID) is highlighted in green. Ta = *Triticum aestivum* L., Gm = *Glycine max*, Os = *Oryza sativa*, Zm = *Zea mays* and At = *Arabidopsis thaliana*.



**Fig S5** Prokaryotic expression analysis of TaGAD2 and TaGAD2 $\Delta$ C recombinant proteins (a) Coomassie brilliant blue staining of purified GST-TaGAD2 (full-length) and GST-TaGAD2 $\Delta$ C (C-terminal truncated TaGAD2) from *Escherichia coli* (BL21). The molecular weight of TaGAD2 and TaGAD2 $\Delta$ C are 54.05 kDa and 50.9 kDa, respectively. (b) Western blot analysis of GST-TaGAD2 and GST-TaGAD2 $\Delta$ C with anti-GST monoclonal antibody at a dilution of 1:5000.



**Fig S6** Effects of *TaGAD2* silencing on agronomic traits in wheat

(a–b) Comparison of GAD activity in rachis (a) and leaves (b) of Fielder and *TaGAD2-RNAi* plants. (c–f) Comparison of flag leaf length (c), spike number per plant (d), thousand-grain weight (e) and grain yield per plant (f) in Fielder and *TaGAD2-RNAi* plants. (g–j) Comparison of the length of BI2 (g), diameter of BI2 (h), fresh weight of BI2 (i) and dry weight of BI2 (j) in Fielder and *TaGAD2-RNAi* plants. Data are presented as means  $\pm$  SD. (a–b,  $n = 3$ . c–f,  $n = 20$ . g–j,  $n = 10$ ). \* $P < 0.05$ , \*\* $P < 0.01$ , ns, not significant. Student's *t* test.