

10.1071/CP20068\_AC

© CSIRO 2020

Supplementary Material: *Crop & Pasture Science*, 2020, **71**, 552–561.

**A genome-wide association study of hexanal content related to soymilk off-flavours in seed of soybean (*Glycine max*)**

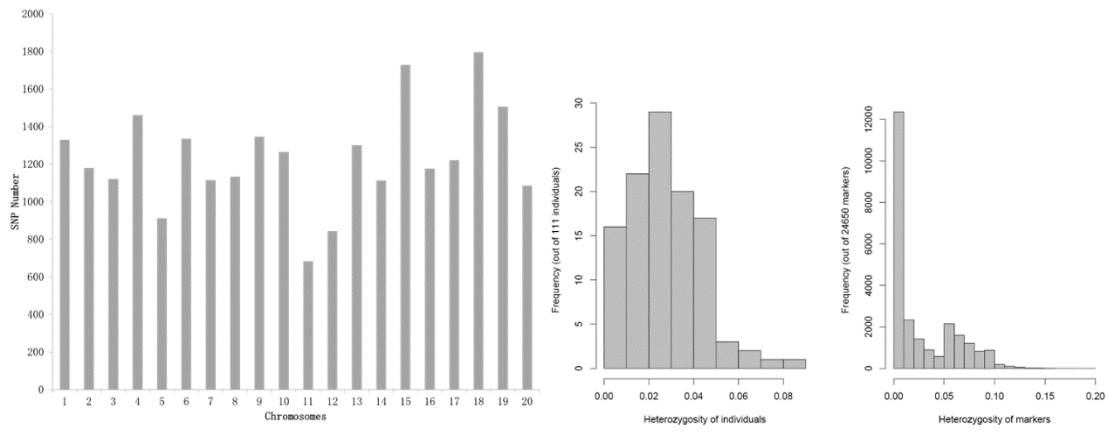
Zhikun Wang<sup>A,\*</sup>, Gege Bao<sup>A,\*</sup>, Chao Yang<sup>A,\*</sup>, Mingming Yang<sup>A</sup>, Xue Zhao<sup>A</sup>, Yupeng Shao<sup>A</sup>, Yuanzhuo Wang<sup>A</sup>, Jinxiu Huang<sup>A</sup>, Ning Xia<sup>A</sup> and Yingpeng Han<sup>A,B</sup>

<sup>A</sup>Key Laboratory of Soybean Biology in Chinese Ministry of Education (Northeastern Key Laboratory of Soybean Biology and Genetics and Breeding in Chinese Ministry of Agriculture), Northeast Agricultural University, Harbin, Heilongjiang 150030, China.

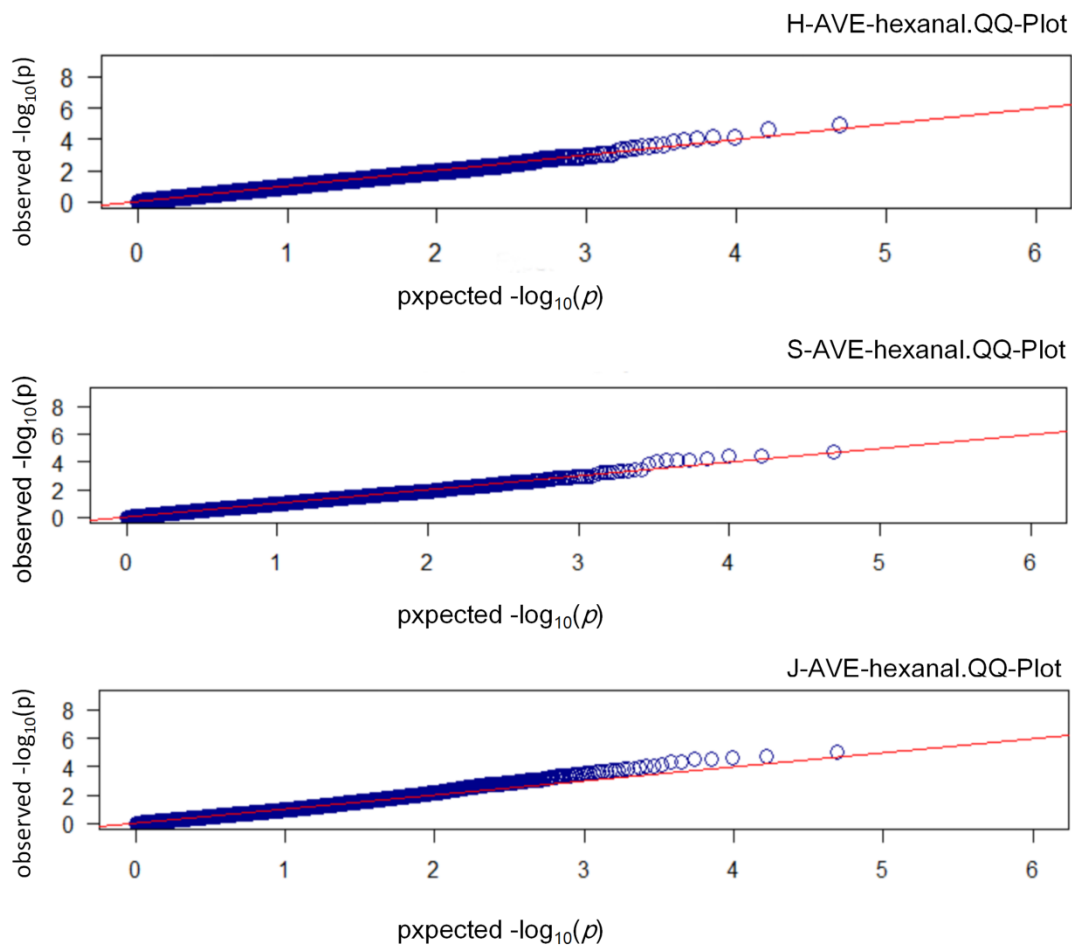
<sup>B</sup>Corresponding author. Email: [hyp234286@aliyun.com](mailto:hyp234286@aliyun.com)

\*These authors contributed equally to the paper.

## Supplementary figures



**Figure S1.** Distribution of the SNP markers across 20 soybean chromosomes.



**Figure S2.** Q-Q plots of GWAS for hexanal content in soybean seed under the CMLM model in three tested environments. H-AVE-hexanal: Harbin, S-AVE-hexanal: Shenyang and J-AVE-hexanal: Gongzhuling.

## Supplementary tables

**Table S1. Analysis of variance of Hexanal content**

Trait	Mean $\pm$ SD (%)	Minimum	Maximum	Skewness	Kurtosis	CV (%)	Environment	Genotype
H-hexanal	911.78 $\pm$ 68.48	42.71	3940.47	1.46	2.39	79	0.61	1.53**
S-hexanal	979.74 $\pm$ 83.59	35.7	5039.83	2.09	5.69	90		
J-hexanal	1033.23 $\pm$ 81.43	24.76	4450.55	1.58	2.84	83		

\*\*Significant at the 0.01 probability level.

**Table S2. Peak SNP associate with Hexanal content and the evaluation of beneficial alleles**

Chromosome	Peak SNP	Position	$-\log_{10}(P)$	R <sup>2</sup>	Environment	MAF	Allele 1	Allele 2	Average hexanal content of accessions with allele 1	Average hexanal content of accessions with allele 2	Average hexanal content of population
3	rs14370224	14370224	4.17/ 4.15	0.23/ 0.25	Harbin/ Gongzhuling	0.19	C	T	830.61/990.47	1259.65/1216.5	911.78/1033.23
3	rs8078768	8078768	4.13/ 4.40	0.23/ 0.26	Harbin/ Gongzhuling	0.19	C	T	826.31/993.84	1290.7/1218.26	911.78/1033.23
3	rs8124219	8124219	4.06/ 4.19	0.23/ 0.25	Harbin/ Gongzhuling	0.19	A	C	835.6/996.64	1251.6/1214.35	911.78/1033.23
3	rs8219886	8219886	3.82/ 4.10	0.22/ 0.25	Harbin/ Gongzhuling	0.18	C	T	826.78/992.65	1342.2/1222.19	911.78/1033.23
3	rs8427416	8427416	3.62/ 4.02	0.21/ 0.24	Harbin/ Gongzhuling	0.17	A	C	822.89/994.21	1342.2/1222.19	911.78/1033.23
3	rs2738098	2738098	3.51/ 3.88	0.20/ 0.24	Harbin/ Gongzhuling	0.14	G	T	874.91/990.27	1130.69/1288.31	911.78/1033.23
3	rs8113305	8113305	3.27/ 3.43	0.19/ 0.22	Harbin/ Gongzhuling	0.17	A	G	842.9/981.64	1267.66/1299.78	911.78/1033.23
3	rs16325590	16325590	3.07/ 3.33	0.18/ 0.21	Harbin/ Gongzhuling	0.18	C	G	830.49/1002.44	1266.7/1278.61	911.78/1033.23
3	rs13198792	13198792	3.00/ 3.31	0.18/ 0.21	Harbin/ Gongzhuling	0.19	G	A	824.54/1000.02	1185.38/1224	911.78/1033.23
6	rs17213652	17213652	3.91/ 4.22	0.22/ 0.25	Harbin/ Gongzhuling	0.10	G	T	852.07/1020.73	1526.86/1077.76	911.78/1033.23
8	rs47787351	47787351	4.91/ 4.72	0.27/ 0.27	Harbin/ Gongzhuling	0.44	T	C	722.27/816.44	1148.51/1300.24	911.78/1033.23
8	rs47793019	47793019	4.62/ 4.47	0.25/ 0.26	Harbin/ Gongzhuling	0.45	C	T	704.11/791.54	1116.1/1308.95	911.78/1033.23
8	rs47634071	47634071	3.61/ 3.49	0.21/ 0.22	Harbin/ Gongzhuling	0.28	C	A	776.2/923.27	1276.95/1317.01	911.78/1033.23
8	rs47495304	47495304	3.42	0.20	Harbin	0.38	A	G	767	1160.92	911.78
8	rs47495282	47495282	3.37	0.20	Harbin	0.36	A	G	773.95	1184.24	911.78
12	rs10960320	10960320	3.04	0.18	Harbin	0.21	C	T	895.23	975.14	911.78
13	rs16756352	16756352	3.58/ 3.38	0.21/ 0.21	Harbin/ Gongzhuling	0.05	G	T	878.5/1011.96	983.95/1406.21	911.78/1033.23
16	rs21755350	21755350	3.44	0.20	Harbin	0.08	G	T	874.39	1335.55	911.78
1	rs45252468	45252468	3.08	0.20	Gongzhuling	0.08	G	T	1001.29	1445.24	1033.23

3	rs2738098	2738098	3.88	0.24	Gongzhuling	0.14	G	T	874.91/990.27	1130.69/1288.31	911.78/1033.23
3	rs8113305	8113305	3.43	0.22	Gongzhuling	0.17	A	G	842.9/981.64	1267.66/1299.78	911.78/1033.23
3	rs16325590	16325590	3.33	0.21	Gongzhuling	0.18	C	G	830.49/1002.44	1266.7/1278.61	911.78/1033.23
3	rs9131478	9131478	3.13	0.20	Gongzhuling	0.18	A	G	1007.07	1278.61	1033.23
3	rs14545182	14545182	3.00	0.20	Gongzhuling	0.18	G	T	993.8	1294.31	1033.23
4	rs51308061	51308061	3.25	0.21	Gongzhuling	0.20	C	T	974.36	1271.4	1033.23
13	rs16756341	16756341	3.28	0.21	Gongzhuling	0.09	G	T	972.26	1631.56	1033.23
2	rs39731258	39731258	3.68	0.21	Shenyang	0.06	G	T	905.24	2147.15	979.74
3	rs22991108	22991108	3.05	0.19	Shenyang	0.08	G	T	898.46	1901	979.74
4	rs32741547	32741547	4.31	0.24	Shenyang	0.10	G	T	866.51	2050.08	979.74
4	rs51990432	51990432	3.75	0.22	Shenyang	0.09	T	C	893.65	1772.06	979.74
5	rs22683109	22683109	4.77	0.26	Shenyang	0.07	C	A	865.27	2354.68	979.74
5	rs39728576	39728576	3.65	0.21	Shenyang	0.30	A	T	755.27	1457.38	979.74
6	rs32257204	32257204	3.90	0.22	Shenyang	0.18	A	T	815.15	1480.73	979.74
6	rs29802429	29802429	3.73	0.22	Shenyang	0.09	T	C	877.73	2107.51	979.74
6	rs29996948	29996948	3.70	0.22	Shenyang	0.16	T	A	833.6	1681.4	979.74
6	rs29776672	29776672	3.54	0.21	Shenyang	0.08	G	A	889.4	2026.49	979.74
6	rs33372485	33372485	3.44	0.20	Shenyang	0.14	A	T	864.64	131.64	979.74
6	rs29867092	29867092	3.32	0.20	Shenyang	0.15	A	G	849.79	1681.39	979.74
6	rs29778546	29778546	3.21	0.20	Shenyang	0.13	C	T	861.89	1626.58	979.74
6	rs30268241	30268241	3.17	0.19	Shenyang	0.17	G	T	853.71	1630.39	979.74
6	rs35199303	35199303	3.11	0.19	Shenyang	0.16	C	A	855.32	1681.4	979.74
6	rs35133276	35133276	3.06	0.19	Shenyang	0.15	T	C	861.57	1681.4	979.74
6	rs35597569	35597569	3.06	0.19	Shenyang	0.15	T	A	861.57	1681.4	979.74
6	rs35803682	35803682	3.06	0.19	Shenyang	0.15	T	C	861.57	1681.4	979.74
6	rs29823324	29823324	3.06	0.19	Shenyang	0.15	A	G	861.57	1681.4	979.74
6	rs35055025	35055025	3.06	0.19	Shenyang	0.15	A	C	861.57	1681.4	979.74
6	rs14582567	14582567	3.04	0.19	Shenyang	0.07	G	T	896.72	2112.82	979.74
7	rs38713209	38713209	3.50	0.21	Shenyang	0.28	A	G	835.19	1370.03	979.74
7	rs36769687	36769687	3.37	0.20	Shenyang	0.46	G	T	1102.56	840.39	979.74
8	rs4039554	4039554	3.05	0.19	Shenyang	0.07	C	A	899.04	2067.39	979.74
9	rs1711748	1711748	3.88	0.22	Shenyang	0.06	G	A	916.09	2093.45	979.74
9	rs47807261	47807261	3.01	0.19	Shenyang	0.06	G	T	904.97	2288.29	979.74
10	rs14726758	14726758	3.53	0.21	Shenyang	0.07	G	T	903	2274.95	979.74
12	rs597529	597529	3.19	0.19	Shenyang	0.11	G	T	874.62	1846.97	979.74
12	rs333151	333151	3.03	0.19	Shenyang	0.13	G	T	883.68	1678.37	979.74
13	rs16474660	16474660	4.50	0.25	Shenyang	0.05	C	A	877.64	2766.56	979.74
14	rs20378672	20378672	3.40	0.20	Shenyang	0.06	G	A	897.12	2440.32	979.74
14	rs22145998	22145998	3.34	0.20	Shenyang	0.12	G	T	862.89	1860.58	979.74

15	rs29554594	29554594	3.58	0.21	Shenyang	0.06	G	T	901.26	2353.15	979.74
15	rs10105204	10105204	3.29	0.20	Shenyang	0.50	C	G	804.52	1097.91	979.74
15	rs39994297	39994297	3.20	0.19	Shenyang	0.09	C	A	875.44	2013.17	979.74
15	rs39554717	39554717	3.01	0.19	Shenyang	0.06	C	A	910.91	2268.31	979.74
16	rs19459031	19459031	4.52	0.25	Shenyang	0.07	G	T	864.29	2199.6	979.74
16	rs30411341	30411341	3.30	0.20	Shenyang	0.26	C	T	769.85	1601.9	979.74
17	rs308719	308719	5.04	0.28	Shenyang	0.07	A	G	858.67	2538.93	979.74
17	rs286113	286113	4.00	0.23	Shenyang	0.07	T	C	0	2375.07	979.74
17	rs20828099	20828099	3.31	0.20	Shenyang	0.06	G	A	899.87	2224.08	979.74
17	rs8999616	8999616	3.03	0.19	Shenyang	0.10	C	T	879.67	1699.45	979.74
18	rs10813971	10813971	3.84	0.22	Shenyang	0.06	G	T	879.86	2104.18	979.74
19	rs40662094	40662094	4.64	0.26	Shenyang	0.06	C	A	871.28	2951.16	979.74
19	rs45683190	45683190	4.10	0.23	Shenyang	0.06	C	T	883.96	1877.01	979.74
19	rs40414937	40414937	3.49	0.21	Shenyang	0.33	T	C	700.33	1572.04	979.74
19	rs26846091	26846091	3.34	0.20	Shenyang	0.08	C	A	880.13	2218.57	979.74
19	rs44084993	44084993	3.32	0.20	Shenyang	0.09	C	A	857.45	1986.59	979.74
19	rs40414951	40414951	3.25	0.20	Shenyang	0.30	G	A	737.35	1579.8	979.74

**Table S3. Gene models in the flanking regions of peak SNP**

Peak SNP	Physical position	Gene model	Start(bp)	End(bp)	Functional annotation
rs2738098	2738098	Glyma.03G024700	2684273	2685143	sulfate transporter 91
		Glyma.03G025100	2719352	2719869	1-amino-cyclopropane-1-carboxylate synthase 2
		Glyma.03G025300	2732998	2733394	regulatory components of ABA receptor 3
		Glyma.03G025400	2768131	2770800	Zinc finger (CCCH-type/C3HC4-type RING finger) family protein
		Glyma.03G025500	2773964	2778371	DHHC-type zinc finger family protein
		Glyma.03G025700	2797162	2797479	Plant self-incompatibility protein S1 family
		Glyma.03G025800	2801117	2801434	Plant self-incompatibility protein S1 family
		Glyma.03G025900	2804869	2805461	Plant self-incompatibility protein S1 family
		Glyma.03G026000	2813567	2814916	Protein of unknown function (DUF1442)
rs8078768	8078768	Glyma.03G026100	2832112	2834920	Exocyst complex component Sec6
		Glyma.03G057100	8001162	8005390	2-oxoglutarate (2OG) and Fe(II)-dependent oxygenase superfamily protein
		Glyma.03G057200	8043283	8044143	thiazole biosynthetic enzyme, chloroplast (ARA6) (THI1) (THI4)
		Glyma.03G057300	8070483	8074031	alfin-like 1
		Glyma.03G057500	8117254	8122189	DNAJ heat shock family protein
rs8113305	8113305	Glyma.03G057600	8164360	8180296	HEAT repeat-containing protein
		Glyma.03G057200	8043283	8044143	thiazole biosynthetic enzyme, chloroplast (ARA6) (THI1) (THI4)
		Glyma.03G057300	8070483	8074031	alfin-like 1
		Glyma.03G057500	8117254	8122189	DNAJ heat shock family protein
		Glyma.03G057600	8164360	8180296	HEAT repeat-containing protein
rs8124219	8124219	Glyma.03G057800	8205989	8218318	Rhodanese/Cell cycle control phosphatase superfamily protein
		Glyma.03G057200	8043283	8044143	thiazole biosynthetic enzyme, chloroplast (ARA6) (THI1) (THI4)
		Glyma.03G057300	8070483	8074031	alfin-like 1
		Glyma.03G057500	8117254	8122189	DNA heat shock family protein
		Glyma.03G057600	8164360	8180296	HEAT repeat-containing protein
rs8219886	8219886	Glyma.03G057800	8205989	8218318	Rhodanese/Cell cycle control phosphatase superfamily protein
		Glyma.03G057600	8164360	8180296	HEAT repeat-containing protein



		Glyma.03G057800	8205989	8218318	Rhodanese/Cell cycle control phosphatase superfamily protein
		Glyma.03G057900	8236657	8237724	Pyridoxal phosphate (PLP)-dependent transferases superfamily protein
		Glyma.03G058000	8249390	8252886	SGNH hydrolase-type esterase superfamily protein
		Glyma.03G058100	8253192	8260260	LMBR1-like membrane protein
		Glyma.03G058200	8267057	8273170	S-adenosyl-L-methionine-dependent methyltransferases superfamily protein
		Glyma.03G058300	8280786	8288390	cation exchanger 3
		Glyma.03G058400	8306189	8315630	regulatory particle AAA-ATPase 2A
rs8427416	8427416	Glyma.03G059000	8500486	8503767	PIF1 helicase
		Glyma.03G059100	8508949	8509829	nodulin MtN21 /EamA-like transporter family protein
rs13198792	13198792	Glyma.03G066500	13131005	13134323	receptor like protein 7
rs14370224	14370224	Glyma.03G068900	14375210	14377147	AtGCP3 interacting protein 1
		Glyma.03G069000	14467258	14467961	CBS / octicosapeptide/Phox/Bemp1 (PB1) domains-containing protein
		Glyma.03G069100	14469382	14474832	RmlC-like cupins superfamily protein
rs16325590	16325590	Glyma.03G070300	16324083	16330477	serine carboxypeptidase-like 19
rs17213652	17213652	Glyma.06G193000	17124047	17126015	TEOSINTE BRANCHED, cycloidea and PCF (TCP) 14
		Glyma.06G193100	17144920	17146388	gibberellin 2-oxidase 8
		Glyma.06G193200	17147417	17151462	NAP1-related protein 2
		Glyma.06G193300	17154238	17158838	S-adenosyl-L-methionine-dependent methyltransferases superfamily protein
		Glyma.06G193400	17161248	17162518	glutathione S-transferase tau 9
		Glyma.06G193500	17163370	17165881	glutathione S-transferase tau 9
		Glyma.06G193600	17224460	17226638	myb domain protein 94
		Glyma.06G193700	17255423	17256578	mini zinc finger
		Glyma.06G193800	17278295	17279753	Gibberellin-regulated family protein
		Glyma.06G193900	17290795	17294406	Exostosin family protein
		Glyma.06G194100	17300062	17304305	RING/FYVE/PHD zinc finger superfamily protein
		Glyma.06G194200	17313012	17314714	Protein of unknown function (DUF3223)
rs47634071	47634071	Glyma.08G363900	47534336	47535993	Zinc-binding dehydrogenase family protein

		Glyma.08G364000	47537290	47543730	TCP-1/cpn60 chaperonin family protein
		Glyma.08G364100	47548864	47550387	carboxyesterase 17
		Glyma.08G364200	47553392	47555880	HEAT repeat-containing protein
		Glyma.08G364300	47556171	47558975	Flavodoxin family protein
		Glyma.08G364600	47565950	47566795	Ribosomal protein PSRP-3/Ycf65
		Glyma.08G364700	47569017	47571100	Regulator of Vps4 activity in the MVB pathway protein
		Glyma.08G364900	47581368	47582279	isopentenyltransferase 5
		Glyma.08G365000	47602097	47606318	cytochrome P450, family 735, subfamily A, polypeptide 1
		Glyma.08G365100	47621018	47622887	LOB domain-containing protein 41
		Glyma.08G365200	47629763	47631058	Nucleic acid-binding, OB-fold-like protein
		Glyma.08G365300	47633207	47634408	Ribulose biphosphate carboxylase (small chain) family protein
		Glyma.08G365600	47650804	47651449	CLPC homologue 1
		Glyma.08G365700	47659642	47662878	abscisic acid (aba)-deficient 4
		Glyma.08G365900	47673091	47677260	Mannose-6-phosphate isomerase, type I
		Glyma.08G366200	47711879	47716127	RNA-binding (RRM/RBD/RNP motifs) family protein
rs47787351	47787351	Glyma.08G366200	47711879	47716127	RNA-binding (RRM/RBD/RNP motifs) family protein
		Glyma.08G366800	47741692	47744899	Peptidyl-tRNA hydrolase family protein
		Glyma.08G366900	47746574	47747680	zinc finger protein 6
		Glyma.08G367000	47755041	47756954	UDP-Glycosyltransferase superfamily protein
		Glyma.08G367100	47766869	47772423	plastidic GLC translocator
		Glyma.08G367200	47774583	47776155	Core-2/I-branching beta-1,6-N-acetylglucosaminyltransferase family protein
		Glyma.08G367300	47777310	47778086	Nodulin MtN3 family protein
		Glyma.08G367400	47783600	47785134	translocase of the inner mitochondrial membrane 13
		Glyma.08G367600	47786586	47786872	NADH-ubiquinone/plastoquinone oxidoreductase chain 4L
		Glyma.08G367800	47807547	47810213	transcription factor jumonji (jmjC) domain-containing protein
rs47793019	47793019	Glyma.08G366200	47711879	47716127	RNA-binding (RRM/RBD/RNP motifs) family protein
		Glyma.08G366800	47741692	47744899	Peptidyl-tRNA hydrolase family protein
		Glyma.08G366900	47746574	47747680	zinc finger protein 6

		Glyma.08G367000	47755041	47756954	UDP-Glycosyltransferase superfamily protein
		Glyma.08G367100	47766869	47772423	plastidic GLC translocator
		Glyma.08G367200	47774583	47776155	Core-2/I-branching beta-1,6-N-acetylglucosaminyltransferase family protein
		Glyma.08G367300	47777310	47778086	Nodulin MtN3 family protein
		Glyma.08G367400	47783600	47785134	translocase of the inner mitochondrial membrane 13
		Glyma.08G367600	47786586	47786872	NADH-ubiquinone/plastoquinone oxidoreductase chain 4L
		Glyma.08G367800	47807547	47810213	transcription factor jumonji (jnjC) domain-containing protein
rs16756352	16756352	Glyma.13G066900	16662928	16667207	methyltransferases
		Glyma.13G067000	16671710	16673786	CLAVATA3/ESR-RELATED 25
		Glyma.13G067100	16679231	16680442	Leucine-rich repeat protein kinase family protein
		Glyma.13G067200	16688567	16689544	Leucine-rich repeat protein kinase family protein
		Glyma.13G067400	16704086	16704947	Putative membrane lipoprotein
		Glyma.13G067500	16729033	16733978	DNase I-like superfamily protein
		Glyma.13G067600	16747744	16749376	Paired amphipathic helix (PAH2) superfamily protein
		Glyma.13G067700	16753333	16759339	hydroxyproline-rich glycoprotein family protein
		Glyma.13G067800	16765722	16775985	SIN3-like 2
		Glyma.13G067900	16787469	16789119	glucosyl transferase family 8
		Glyma.13G068100	16805832	16813055	golgi alpha-mannosidase II
		Glyma.13G068200	16825383	16836935	Major facilitator superfamily protein
		Glyma.13G068500	16851649	16854206	cytochrome P450, family 82, subfamily C, polypeptide 2

---

**Table S4. Significant SNP candidate genes associated with hexanal content**

Gene ID	Chromosome	Physical position	Location	Region	Alleles	$-\log_{10}(p)$	Functional annotation		
Glyma.08G364100	8	47548933	Harbin	UTR5	T/C	3.22	carboxyesterase 17		
			Gongzhuling			0.05			
		47549233	Shengyang	synonymous SNV	0.56				
			Harbin		2.74				
			Gongzhuling		1.43				
		47549904	Shengyang	nonsynonymous SNV	1.00				
			Harbin		2.07				
Glyma.08G364200	8	47553429	Harbin	UTR5	T/C	0.97	HEAT repeat-containing protein		
			Gongzhuling			0.57			
Glyma.08G364300	8	47553542	Harbin	intronic		2.74			
			Gongzhuling			1.43			
		47554484	Shengyang	intronic	1.00				
			Harbin		2.44				
		47554581	Gongzhuling	nonsynonymous SNV	2.18				
			Shengyang		1.32				
		Glyma.08G364300	8	47557510	Harbin	intronic	T/C	2.75	Flavodoxin family protein
					Gongzhuling			1.43	
				47557629	Shengyang	intronic	0.99		
					Harbin		2.94		
47558300	Gongzhuling			nonsynonymous SNV	1.30				
	Shengyang				0.87				
47558521	Harbin			nonsynonymous SNV	2.04				
	Gongzhuling				1.2				
47558521	Shengyang	nonsynonymous SNV	1.00						
	Harbin		2.1						
47558521	Gongzhuling	nonsynonymous SNV	0.83						

Glyma.08G365700	8	47660137	Shengyang	intronic	C/T	0.75	Abscisic acid (aba)-deficient 4
			Harbin			2.75	
			Gongzhuling			1.43	
		47661670	Shengyang	intronic	0.99		
			Harbin		2.44		
			Gongzhuling		1.01		
			Shengyang		0.41		

---

**Table S5. Source and phenotype data of 111 soybean accessions**

Name	Country	Latitude (°N)	Longitude (°W)	Phenotypic data		
				Harbin (ng mL <sup>-1</sup> )	Shengyang (ng mL <sup>-1</sup> )	Gongzhuling (ng mL <sup>-1</sup> )
HN51	China	48.29	128.08	556.51	2394.46	486.15
HF47	China	48.29	128.08	399.31	1125.04	683.33
HF50	China	48.29	128.08	477.65	414.16	1577.08
KF18	China	48.29	128.08	390.74	762.30	950.24
KF14	China	48.29	128.08	2408.55	831.25	392.18
HuJiao4403 (Hujiao03-286)	China	48.29	128.08	563.91	577.52	2599.22
HN48	China	48.29	128.08	1556.05	659.02	1075.38
DN46	China	48.29	128.08	1634.14	2496.41	1213.03
DN49	China	48.29	128.08	1216.61	1159.78	4450.55
Hangbaodou	China	40.845	121.995	81.99	55.94	41.98
HF25	China	48.29	128.08	454.93	737.3	826.75
Small yellow	China	37.385	112.235	1428.54	514.22	1363.79
BF9	China	48.29	128.08	2066.21	1186.99	1299.41
Fenshou6	China	48.29	128.08	469.57	2479.43	1136.05
NF11	China	48.29	128.08	1962.18	335.54	205.53
HN44	China	48.29	128.08	203.53	671.38	662.30
DN42	China	48.29	128.08	1025.96	255.99	715.57
Heimodou	China	43.35	126.285	179.68	202.93	187.15
Douludou	China	43.35	126.285	677.90	876.85	726.53
KJ23	China	48.29	128.08	366.59	2584.92	447.89
HH48	China	48.29	128.08	671.33	5039.83	690.12
DN48	China	48.29	128.08	643.07	736.13	923.47
SN10	China	48.29	128.08	1456.00	302.16	367.22
DN594	China	48.29	128.08	1358.20	1447.55	1955.2

DN1068	China	48.29	128.08	2701.30	1968.26	206.77
DN43	China	48.29	128.08	481.14	1561.26	1188.78
Xian3	China	48.29	128.08	1269.55	1198.79	507.37
JL30	China	43.35	126.285	58.96	55.75	59.73
Jshanmoshi	China	43.35	126.285	269.56	455.35	582.8
JY94	China	43.35	126.285	259.01	438.28	1076.46
JY89	China	37.385	112.235	476.04	1099.19	572.93
JN20	China	43.35	126.285	312.07	855.51	1143.61
HYoutai	China	43.35	126.285	775.17	922.54	294.71
L-28	Canada	43.4	79.25	396.76	2167.62	2035.72
JD33	China	40.845	121.995	618.01	808.79	214.41
TF8	China	40.845	121.995	271.31	471.66	230.07
Tejia	China	43.35	126.285	803.88	699.86	1857.47
LD23	China	40.845	121.995	2079.04	166.47	1018.16
TD58	China	40.845	121.995	42.71	35.70	36.15
Bmoshi	China	43.35	126.285	48.97	37.85	68.33
L-9	America	41.83	92.905	671.64	485.39	613.07
L-10	America	41.83	92.905	1004.21	404.02	368.87
MD14	China	44.49	111.695	1410.27	1665.06	910.04
Big black	China	36.225	118.31	1153.60	853.02	1419.41
Heersong2	Ukraine	50.28	30.29	589.93	327.07	2644.94
Nova	Italy	41.54	12.3	477.17	2025.05	348.45
Domaka Tolisa-A	Yugoslavia	46.3	14.3	392.47	441.42	375.57
Aika166	Rumania	44.23	26.1	1382.74	2744.45	735.98
Yapiche	China	48.29	128.08	999.52	2895.78	2023.57
Cse	China	43.35	126.285	559.81	631.97	480.86
ZD35	China	40.145	116.275	3940.47	291.92	1007.85
Stone	China	39.19	116.285	654.20	968.43	472.9

JD17	China	39.19	116.285	707.93	534.2	433.25
4five-star	China	39.19	116.285	341.18	445.24	530.22
Datenhei	China	39.19	116.285	204.88	145.91	87.57
Z03-5334	China	40.145	116.275	1176.64	633.92	796.96
Z03-5179	China	40.145	116.275	464.60	505.64	751.25
ZD27	China	40.145	116.275	293.32	366.05	461.32
ZZ00-683	China	40.145	116.275	404.25	775.31	2805.57
SN1	China	48.29	128.08	188.47	321.19	489.93
HH18	China	48.29	128.08	2188.22	457.89	2246.8
MF1	China	48.29	128.08	1946.36	1301.58	1145.31
KB1	China	48.29	128.08	325.47	1938.48	287.96
HF35	China	48.29	128.08	990.59	1294.52	2608.61
HF11	China	48.29	128.08	827.05	1150.96	529.84
LP03-11	China	48.29	128.08	324.30	3053.24	1829.68
LongX1	China	48.29	128.08	246.37	812.42	1933.00
HF29	China	48.29	128.08	1542.76	372.79	4163.98
HF37	China	48.29	128.08	890.23	620.15	543.51
DN07-9909	China	48.29	128.08	1639.90	878.84	408.51
HF45	China	48.29	128.08	616.96	805.51	542.31
HF55	China	48.29	128.08	2951.02	625.17	1231.7
BD16	China	48.29	128.08	577.62	253.01	803.88
HuaJiang4403	China	48.29	128.08	1401.46	3145.22	1088.99
B1484	China	48.29	128.08	471.62	913.09	457.55
B1361	China	48.29	128.08	1085.56	1133.09	582.80
B1873	China	48.29	128.08	370.56	848.51	1338.55
B4834	China	48.29	128.08	497.32	281.43	811.56
SN30	China	48.29	128.08	1188.3	1723.26	2692.28
K04-8579	China	48.29	128.08	2296.38	258.58	812.85



S03-3046	China	48.29	128.08	1774.64	1623.56	1234.15
S03-3952	China	48.29	128.08	2115.47	1820.54	1550.82
S05-7304	China	48.29	128.08	1524.21	1632.67	1933.05
KN30	China	48.29	128.08	510.70	4621.05	547.44
KN29	China	48.29	128.08	968.77	332.84	1265.51
KN22	China	48.29	128.08	492.16	639.32	254.14
HN55	China	48.29	128.08	1775.50	467.67	2118.01
SN29	China	48.29	128.08	1258.26	1100.53	2900.25
JN21	China	43.35	126.285	669.44	1154.45	486.15
LD3	China	40.845	121.995	726.05	721.92	1209.75
L98072	China	40.845	121.995	641.36	406.41	2665.64
TD50	China	40.845	121.995	310.49	616.67	346.45
HuJiao4403 (Hujiao03-286)	China	48.29	128.08	617.88	290.02	738.56
DY2004-5	China	43.35	126.285	1041.18	382.05	735.45
JL47	China	43.35	126.285	586.29	630.53	734.33
H04-1824	China	48.29	128.08	2614.33	1599.69	899.55
DN L-13	Canada	43.4	79.25	1590.59	992.94	1430.35
L-57	America	41.83	92.905	614.84	211.56	1247.09
L-21	America	41.83	92.905	417.58	457.43	1155.72
Z30	China	40.145	116.275	617.43	358.99	1013.21
TD52	China	40.845	121.995	580.49	694.19	2594.83
TD54	China	40.845	121.995	81.15	49.75	24.76
Harvest10	China	48.29	128.08	452.18	1297.14	754.99
Jin13	China	39.19	116.285	61.87	79.43	55.55
YF31	China	40.845	121.995	562.38	720.63	466.62
Z95-5388	China	40.145	116.275	349.01	591.08	314.64
Z20	China	40.145	116.275	1027.65	534.86	329.08
SN4	China	48.29	128.08	997.37	1876.31	1088.07

SN8	China	48.29	128.08	854.37	586.66	312.79
HN33	China	48.29	128.08	2433.25	1592.21	3083.12
SN20	China	48.29	128.08	433.15	549.24	1311.95

---