Table S3 Genomic Information for the 58 *a priori* Candidate Genes (A)

***a priori* candidate gene pathway**	**MaizeGDB Name**	**MaizeGDB Full Name**	**MaizeGDB Synonym(s)**	**RefGen_v2 Gene Model ID**	**Annotated Gene Function**	**RefGen_v2 Chromosome**	**RefGen_v2 ORF Start bp**	**RefGen_v2 ORF Stop bp**
carotenoid_synthesis_and_degradation	ao1	aldehyde oxidase1	ao1, cl1856_2b, aldehyde oxidase1	GRMZM2G141535	Aldehyde oxidase and xanthine dehydrogenase	1	286,448,581	286,456,365
carotenoid_synthesis_and_degradation	ao2	aldehyde oxidase2	ao2	GRMZM5G899851	Aldehyde oxidase and xanthine dehydrogenase	5	4,588,532	4,592,775
carotenoid_synthesis_and_degradation	ao3	aldehyde oxidase3	ao3, TMR51, aldehyde oxidase3, GRMZM2G124260, rs131175362, ss196414838, pzb01403, IDP2436	GRMZM2G019799	Aldehyde oxidase and xanthine dehydrogenase	1	286,358,278	286,366,211
carotenoid_synthesis_and_degradation	ao4	aldehyde oxidase4	ao4	GRMZM2G141473	Aldehyde oxidase and xanthine dehydrogenase	1	286,506,118	286,513,080
carotenoid_synthesis_and_degradation	ao5	aldehyde oxidase5	ao5	GRMZM2G406830	Aldehyde oxidase and xanthine dehydrogenase	7	7,446,258	7,451,594
carotenoid_synthesis_and_degradation	ccd7	carotenoid cleavage dioxygenase7	ccd7	GRMZM2G158657	*carotenoid cleavage dioxygenase7	2	19,458,968	19,461,625
carotenoid_synthesis_and_degradation	ccd8	carotenoid cleavage dioxygenase8	ccd8, ccd8a, Zmccd8	GRMZM2G446858	*carotenoid cleavage dioxygenase8	3	197,015,856	197,019,350
Prenyl_Group_Synthesis	chph1	chlorophyllase1	chph1	GRMZM2G170734	chlorophyllase, chloroplast	7	62,130,993	62,132,323
Prenyl_Group_Synthesis	cmk1	4-diphosphocytidyl-2-C-methyl-D-erythritol kinase1	cmk1, umc2169, 4-diphosphocytidyl-2-C-methyl-D-erythritol kinase1, cdp-me kinase1, cdpmek1	GRMZM5G859195	4-diphosphocytidyl-2-C-methyl-D-erythritol kinase	3	187,922,271	187,927,591
carotenoid_synthesis_and_degradation	crti1	carotene isomerase1	crti1, carotenoid isomerase1, CRTISO1	GRMZM2G108457	carotenoid isomerase	4	200,869,070	200,873,710
carotenoid_synthesis_and_degradation	crti2	carotene isomerase2	crti2, carotenoid isomerase2, CRTISO2	GRMZM2G106531	carotenoid isomerase	2	226,366,352	226,371,341
carotenoid_synthesis_and_degradation	crti3	carotene isomerase3	crti3, CRTISO3	GRMZM2G144273	carotenoid isomerase	5	1,333,304	1,341,577
carotenoid_synthesis_and_degradation	cyp13	cytochrome P450 13	cyp13, Cytochrome P450, CYP97A16, lutein5, lut5, CYP97A	GRMZM5G837869	CYP97A3, Cytochrome P450 beta-ring hydroxylase	5	215,827,224	215,831,730
carotenoid_synthesis_and_degradation	cyp14	cytochrome P450 14	cyp14, CYP97C, lutein1, lut1, cytochrome P450-type monooxygenase CYP97C1	GRMZM2G143202	CYP97A3, Cytochrome P450 epsilon-ring hydroxylase	1	86,838,334	86,848,726
carotenoid_synthesis_and_degradation	cyp15	cytochrome P450 15	cyp15, CYP97B, cytochrome P450-type monooxygenase CYP97B3	GRMZM2G010221	CYP97B, cytochrome P450	4	235,724,340	235,728,875
Prenyl_Group_Synthesis	dmes1	4-Diphosphocytidyl-2C-methyl-D-erythritol synthase1	dmes1, si618008b02(470), si618008b02f	GRMZM5G856881	2-C-methyl-D-erythritol 4-phosphate cytidyltransferase	3	170,115,790	170,118,780
Prenyl_Group_Synthesis	dmes2	4-Diphosphocytidyl-2C-methyl-D-erythritol synthase2	dmes2	GRMZM2G172032	2-C-methyl-D-erythritol 4-phosphate cytidyltransferase	8	164,748,939	164,752,371
Prenyl_Group_Synthesis	dxr1	deoxy xylulose reductoisomerase1	dxr1, IDP154, deoxy xylulose reductoisomerase1, 1-deoxy-D-xylulose 5-phosphate reductoisomerase1, CL389_1(210), CL389_1b	GRMZM2G056975	1-deoxy-D-xylulose 5-phosphate reductoisomerase	3	30,226,804	30,233,358
Prenyl_Group_Synthesis	dxr2	deoxy xylulose reductoisomerase2	dxr2	GRMZM2G036290	1-deoxy-D-xylulose 5-phosphate reductoisomerase	8	8,094,442	8,101,055
Prenyl_Group_Synthesis	dxs1	deoxy xylulose synthase1	dxs1, PZA02247, CL392_1, AY110050, deoxy xylulose synthase1	GRMZM2G137151	1-deoxy-D-xylulose 5-phosphate synthase	6	146,378,393	146,382,661
Prenyl_Group_Synthesis	dxs2	deoxy xylulose synthase2	dxs2, CL732_-1, deoxy xylulose synthase2	GRMZM2G493395	1-deoxy-D-xylulose 5-phosphate synthase	7	14,077,852	14,081,075
Prenyl_Group_Synthesis	dxs3	deoxy xylulose synthase3	dxs3, pco071268	GRMZM2G173641	1-deoxy-D-xylulose 5-phosphate synthase	9	20,462,059	20,467,072
Prenyl_Group_Synthesis	ggh1	geranylgeranyl hydrogenase1	ggh1	GRMZM2G105644	geranylgeranyl reductase	5	206,890,298	206,892,838
Prenyl_Group_Synthesis	ggh2	geranylgeranyl hydrogenase2	ggh2	GRMZM2G419111	geranylgeranyl reductase	3	40,062,008	40,064,270
Prenyl_Group_Synthesis	ggps1	geranylgeranyl pyrophosphate synthase1	ggps1, GGPPS1, ggdps1	AC194970.5_FG001	geranylgeranyl pyrophosphate synthase	2	207,236,995	207,238,335
Prenyl_Group_Synthesis	ggps2	geranylgeranyl pyrophosphate synthase2	ggps2, GGPPS2, ggdps2	GRMZM2G102550	geranylgeranyl pyrophosphate synthase	7	160,531,537	160,533,586
Prenyl_Group_Synthesis	ggps3	geranylgeranyl pyrophosphate synthase3	ggps3, GGPPS3, ggdps3	GRMZM2G058404	geranylgeranyl pyrophosphate synthase	8	6,358,798	6,360,117
Prenyl_Group_Synthesis	hds1	hydroxymethylbutenyl diphosphate synthase1	hds1, 4-hydroxy-3-methylbut-2-en-1-yl diphosphate synthase1, Hydroxymethylbutenyl diphosphate synthase1	GRMZM2G137409	4-hydroxy-3-methylbut-2-enyl diphosphate synthase	5	182,124,005	182,130,631
carotenoid_synthesis_and_degradation	hyd3	hydroxylase3	hyd3, crtRB1, beta-carotene hydroxylase 1, CrtR-B1, bch2	GRMZM2G152135	Beta-carotene hydroxylase (non-heme dioxygenase type)	10	136,057,100	136,060,219
carotenoid_synthesis_and_degradation	hyd4	hydroxylase4	hyd4, bch1, crtRB3, HYD1, beta-carotene hydroxylase homolog, BCH1	GRMZM2G164318	Beta-carotene hydroxylase (non-heme dioxygenase type)	2	15,865,938	15,868,219
carotenoid_synthesis_and_degradation	hyd5	hydroxylase5	hyd5, crtRB5	GRMZM2G382534	Beta-carotene hydroxylase (non-heme dioxygenase type)	9	153,692,212	153,694,576
carotenoid_synthesis_and_degradation	hyd6	hydroxylase6	hyd6, crtRB2, beta-carotene hydroxylase homolog	GRMZM2G090051	Beta-carotene hydroxylase (non-heme dioxygenase type)	1	5,380,152	5,382,574
carotenoid_synthesis_and_degradation	hyd7	hydroxylase7	hyd7, crtRB4, hydroxylase7	GRMZM2G163683	Beta-carotene hydroxylase (non-heme dioxygenase type)	4	236,023,117	236,025,051
carotenoid_synthesis_and_degradation	hyd8	hydroxylase8	hyd8	GRMZM5G826824	Beta-carotene hydroxylase (non-heme dioxygenase type)	1	6,353,416	6,354,652
Prenyl_Group_Synthesis	ippi1	isopentenyl pyrophosphate isomerase1	ippi1, isopentenyl diphosphate isomerase1, isopentenyl pyrophosphate isomerase1	GRMZM2G108285	isopentenyl pyrophosphate isomerase	7	155,559,747	155,562,921
Prenyl_Group_Synthesis	ippi2	isopentenyl pyrophosphate isomerase2	ippi2, isopentenyl pyrophosphate isomerase2, isopentenyl diphosphate isomerase2	GRMZM2G145029	isopentenyl pyrophosphate isomerase	8	104,659,886	104,663,941
Prenyl_Group_Synthesis	ippi3	isopentenyl pyrophosphate isomerase3	ippi3, isopentenyl pyrophosphate isomerase3, isopentenyl diphosphate isomerase3	GRMZM2G133082	isopentenyl pyrophosphate isomerase	6	147,131,116	147,136,679
Prenyl_Group_Synthesis	lw1	lemon white1	lw1, luteus17, zebra crossbands7, zb7, zb*-N101, zb*-101, ispH, hydroxymethylbutenyl diphosphate reductase1, hmdr1, hdr1, blt1, blotchedN43, 4-hydroxy-3-methylbut-2-enyl diphosphate reductase1,	GRMZM2G027059	4-hydroxy-3-methylbut-2-enyl diphosphate reductase	1	272,936,836	272,940,502

			l17, lemon white1					
carotenoid_synthesis_and_degradation	lyce1	lycopene epsilon cyclase1	lyce1, lcye1, lycE, lcyE, LCY-E, lycopene epsilon cyclase1	GRMZM2G012966	lycopene epsilon-cyclase	8	138,882,594	138,889,812
Prenyl_Group_Synthesis	mecs1	2-C-methyl-D-erythritol 2,4-cyclodiphosphate synthase1	mecs1	GRMZM5G835542	2-C-methyl-D-erythritol 2,4-cyclodiphosphate synthase	4	155,830,779	155,832,786
Prenyl_Group_Synthesis	mecs2	2-C-methyl-D-erythritol 2,4-cyclodiphosphate synthase2	mecs2	AC209374.4_FG002	2-C-methyl-D-erythritol 2,4-cyclodiphosphate synthase	5	196,279,295	196,281,037
carotenoid_synthesis_and_degradation	nced2	nine-cis-epoxycarotenoid dioxygenase2	nced2, NCED2, 9-cis-epoxycarotenoid dioxygenase5a, NCED5a, vp14 homolog	GRMZM2G407181	*9-cis-epoxycarotenoid dioxygenase5a	1	174,524,887	174,527,795
carotenoid_synthesis_and_degradation	nced3	nine-cis-epoxycarotenoid dioxygenase3	nced3, vp14 homolog, 9-cis-epoxycarotenoid dioxygenase5b, NCED5b, NCED3	GRMZM5G858784	*9-cis-epoxycarotenoid dioxygenase5b	3	87,344,791	87,346,554
carotenoid_synthesis_and_degradation	nced4	nine-cis-epoxycarotenoid dioxygenase4	nced4, NCED9a, vp14 homolog, 9-cis-epoxycarotenoid dioxygenase9a	GRMZM2G408158	*9-cis-epoxycarotenoid dioxygenase9a	2	234,574,835	234,576,854
carotenoid_synthesis_and_degradation	nced5	nine-cis-epoxycarotenoid dioxygenase5	nced5, 9-cis-epoxycarotenoid dioxygenase9b, NCED9b, vp14 homolog	GRMZM2G417954	*9-cis-epoxycarotenoid dioxygenase9b	7	5,976,197	5,978,481
carotenoid_synthesis_and_degradation	nced6	nine-cis-epoxycarotenoid dioxygenase6	nced6, NCED6, Carotenoid cleavage dioxygenase4a, CCD4a	GRMZM2G110192	*carotenoid cleavage dioxygenase4a	4	159,724,032	159,726,475
carotenoid_synthesis_and_degradation	nced7	nine-cis-epoxycarotenoid dioxygenase7	nced7, NCED9c, vp14 homolog, 9-cis-epoxycarotenoid dioxygenase9c	GRMZM2G330848	*9-cis-epoxycarotenoid dioxygenase9c	7	175,861,745	175,863,458
carotenoid_synthesis_and_degradation	nced8	nine-cis-epoxycarotenoid dioxygenase8	nced8, NCED5, Carotenoid cleavage dioxygenase4b, CCD4b	GRMZM2G150363	*carotenoid cleavage dioxygenase4b	5	200,687,176	200,689,579
carotenoid_synthesis_and_degradation	nced9	nine-cis-epoxycarotenoid dioxygenase9	nced9, NCED9d, 9-cis-epoxycarotenoid dioxygenase9d	GRMZM5G838285	*9-cis-epoxycarotenoid dioxygenase9d	5	16,850,172	16,851,977
carotenoid_synthesis_and_degradation	ps1	pink scutellum1	ps1, ps*-Mu85-3061-21, lycb1, lcyb1, lcyb, lycB, vp7, ps*-8205, pink scutellum1, lyc1, ps*-85-3288-28	GRMZM5G849107	lycopene beta-cyclase	5	100,700,176	100,702,026
carotenoid_synthesis_and_degradation	psy2	phytoene synthase2	psy2, csu572, pco131047(641), PCO131047b, phytoene synthase2	GRMZM2G149317	phytoene synthase	8	168,273,042	168,276,092
carotenoid_synthesis_and_degradation	vde1	violaxanthin de-epoxidase1	vde1, si605018d09, VDE, violaxanthin de-epoxidase1	GRMZM2G027219	violaxanthin de-epoxidase	2	74,086,504	74,089,290
carotenoid_synthesis_and_degradation	vp14	viviparous14	vp14, NCED1, nine-cis-epoxycarotenoid dioxygenase1, NCED1 homolog, siu95953a(82), siu95953a, viviparous14, umc1218, ufg4	GRMZM2G014392	*9-cis-epoxycarotenoid dioxygenase1	1	250,892,567	250,895,242
carotenoid_synthesis_and_degradation	vp5	viviparous5	vp5, viviparous5, MAGI_109001, PZB00718, MAGI_22938, umc1070, phytoene desaturase, L39266, pds*-L39266, PZB00648, PZA02069, CL1803_1, phytoene desaturase, pds1, vp5-8419, y-vp*-8419, y-vp*-83-3101-36, y-vp*-85-3101-36, vp5-83-3101-36	GRMZM2G410515	phytoene desaturase	1	17,660,941	17,667,054
carotenoid_synthesis_and_degradation	wc1	white cap1	wc1, ccd1, ZmCCD1, PCO084517, AY106323, IDP700, white cap1	GRMZM2G057243	*carotenoid cleavage dioxygenase1	9	152,086,899	152,092,882
carotenoid_synthesis_and_degradation	y1	yellow endosperm1	y1, y1ssr, rs131175743, rs130328408, y4, yellow endosperm1, white1, pb1, Psy1	GRMZM2G300348	phytoene synthase	6	82,017,148	82,021,007
carotenoid_synthesis_and_degradation	zds1	zeta carotene desaturase1	zds1, zeta carotene desaturase candidate, cl78_1(541), CL78_1	GRMZM2G454952	zeta-carotene desaturase	7	17,470,585	17,479,020
carotenoid_synthesis_and_degradation	zep1	zeaxanthin epoxidase1	zep1, fha5, TMR41	GRMZM2G127139	zeaxanthin epoxidase	2	44,440,299	44,449,237

Genomic information for the 58 *a priori* candidate genes involved in the biosynthesis of isoprenoids and carotenoids, as well as the degradation of carotenoids.

*Carotenoid cleavage enzymes fall into to major phyletic groups, the carotenoid cleavage dioxygenases (which generally have broad substrate specificity) and the NCED clade, which are involved in ABA synthesis and highly specific for 9-cis-epoxycarotenoids. Note that with the exception of ZmCCD1 and ZmNCED1 (vp14) maize carotenoid cleavage family membes have not had their biochemical activities determined. Nomenclature of other maize family members is relative to their most closely related sequencein Arabidopsis but this does not necessarily imply a corresponding biochemical activity for the maize enzyme. Nomenclature is as listed in maizeGDB v3.

Table S3 Genomic Information for the 8 *a priori* Candidate Genes (B)

***a priori* candidate gene pathway**	**MaizeGDB Name**	**MaizeGDB Full Name**	**MaizeGDB Synonym(s)**	**RefGen_v2 Gene Model ID**	**Annotated Gene Function**	**RefGen_v2 Chromosome**	**RefGen_v2 ORF Start bp**	**RefGen_v2 ORF Stop bp**
carotenoid_synthesis_and_degradation	cyp14	cytochrome P450 14	cyp14, CYP97C, lutein1, lut1, cytochrome P450-type monooxygenase CYP97C1	GRMZM2G143202	CYP97A3, Cytochrome P450 epsilon-ring hydroxylase	1	86838334	86848726
carotenoid_synthesis_and_degradation	hyd4	hydroxylase4	hyd4, bch1, crtRB3, HYD1, beta-carotene hydroxylase homolog, BCH1	GRMZM2G164318	Beta-carotene hydroxylase (non-heme dioxygenase type)	2	15865938	15868219
carotenoid_synthesis_and_degradation	zep1	zeaxanthin epoxidase1	zep1, fha5, TMR41	GRMZM2G127139	zeaxanthin epoxidase	2	44440299	44449237
carotenoid_synthesis_and_degradation	y1	yellow endosperm1	y1, y1ssr, rs131175743, rs130328408, y4, yellow endosperm1, white1, pb1, Psy1	GRMZM2G300348	phytoene synthase	6	82017148	82021007
carotenoid_synthesis_and_degradation	zds1	zeta carotene desaturase1	zds1, zeta carotene desaturase candidate, cl78_1(541), CL78_1	GRMZM2G454952	zeta-carotene desaturase	7	17470585	17479020
carotenoid_synthesis_and_degradation	lyce1	lycopene epsilon cyclase1	lyce1, lcye1, lycE, lcyE, LCY-E, lycopene epsilon cyclase1	GRMZM2G012966	lycopene epsilon-cyclase	8	138882594	138889812
carotenoid_synthesis_and_degradation	wc1	white cap1	wc1, ccd1, ZmCCD1, PCO084517, AY106323, IDP700, white cap1	GRMZM2G057243	*carotenoid cleavage dioxygenase1	9	152086899	152092882
carotenoid_synthesis_and_degradation	hyd3	hydroxylase3	hyd3, crtRB1, beta-carotene hydroxylase 1, CrtR-B1, bch2	GRMZM2G152135	Beta-carotene hydroxylase (non-heme dioxygenase type)	10	136057100	136060219

Genomic information for the eight candidate genes that are hypothesized to be critical for marker-assisted selection for orange-colored maize kernels with high total carotenoid and provitamin A levels.

*Carotenoid cleavage enzymes fall into to major phyletic groups, the carotenoid cleavage dioxygenases (which generally have broad substrate specificity) and the NCED clade, which are involved in ABA synthesis and highly specific for 9-cis-epoxycarotenoids. Note that with the exception of ZmCCD1 and ZmNCED1 (vp14) maize carotenoid cleavage family membes have not had their biochemical activities determined. Nomenclature of other maize family members is relative to their most closely related sequencein Arabidopsis but this does not necessarily imply a corresponding biochemical activity for the maize enzyme. Nomenclature is as listed in maizeGDB v3.