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Supplementary Data

Rational identification of target enzymes for starch improvement through system-level analysis of a potato tuber model

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Supplementary Table 1. Initial concentrations of all metabolites

Metabolite	**Concentration (mM)**	**Reference**
Suc_cyt	1	Arbitrarily
UDP_cyt	0.0524	Tiessen et al. (2002)
UDPglc_cyt	0.571	Tiessen et al. (2002)
Fru_cyt	1.37	Tiessen et al. (2002)
PP_cyt	0.012*	Tiessen et al. (2002)
G1P_cyt	0.0427	Tiessen et al. (2002)
UTP_cyt	0.238	Tiessen et al. (2002)
G6P_cyt	0.51	Tiessen et al. (2002)
ATP_cyt	0.292	Tiessen et al. (2002)
F6P_cyt	0.147	Tiessen et al. (2002)
ADP_cyt	0.0873	Tiessen et al. (2002)
Glc_cyt	10	Arbitrarily
Pi_cyt	2.4	Tiessen et al. (2002)
S6P_cyt	0	Arbitrarily
G6P_amp	0.379	Tiessen et al. (2002)
G1P_amp	0	Arbitrarily
ATP_amp	0.179	Tiessen et al. (2002)
ADPglc_amp	0	Arbitrarily
PP_amp	0.00236	Tiessen et al. (2002)
AL_amp	0	Arbitrarily
LG_amp	0	Arbitrarily
PG_amp	0	Arbitrarily
AP_amp	0	Arbitrarily
ADP_amp	0.149	Tiessen et al. (2002)
Pi_amp	0.87	Tiessen et al. (2002)
Suc_supply	300*	Kühn et al. (1999)
PGA3_amp	0.198*	Tiessen et al. (2002)
Glc_a	0	Arbitrarily
Glc_b	0	Arbitrarily

Note: * is a constant during simulation. PGA3_amp, Glc_a, and Glc_b are used in rate laws that are not shown in Fig. 1 in the main text.

Supplementary Table 2. Rate laws for enzymes, transporters and summarized reactions and the values of kinetic parameters used in the constructed model

Name	Reaction Rate

ST

An irreversible uni-uni Michaelis-Menten mechanism (Kühn et al., 1999).

$$V1 = v_{\max} \frac{[Suc_{supply}]}{K_{m,Suc} + [Suc_{supply}]}$$

Parameter	Value	Reference	Parameter	Value	Reference
v_{max}	1.3833E-4	Weise et al. (2000)	$K_{m,Suc}$	6	Weise et al. (2000)

SuSy
EC 2.4.1.13

A reversible ordered bi-reactant mechanism with UDP binding first and UDPglc dissociating last from the enzyme (Junker, 2004).

$$V2 = v_f \frac{[UDP][Suc] - \frac{[Fru][UDPglc]}{K_{eq}}}{[UDP][Suc]\left(1+\frac{[Fru]}{K_{i,Fru}}\right) + K_{m,Suc}\left([UDP]+K_{i,UDP}\right) + K_{m,UDP}[Suc] + \frac{v_f}{v_r K_{eq}} \times \left[[Fru]K_{m,UDPglc}\left(1+\frac{[UDP]}{K_{i,UDP}}\right) + [UDPglc]\left\{K_{m,Fru}\left(1+\frac{K_{m,UDP}[Suc]}{K_{i,UDP}K_{m,Suc}}\right) + [Fru]\left(1+\frac{[Suc]}{K_{i,Suc}}\right)\right\}\right]}$$

Parameter	Value	Reference	Parameter	Value	Reference
v_f	0.035	Junker (2004)	$K_{m,Fru}$	7.8	Junker (2004)
v_r	0.08	”	$K_{m,UDPqlc}$	0.076	”
K_{eq}	0.36	”	$K_{i,UDP}$	0.058	”
$K_{m,Suc}$	50	”	$K_{i,Fru}$	7.8	”
$K_{m,UDP}$	0.058	”	$K_{i,Suc}$	40	”

UGPase
EC 2.7.7.9

The “ordered Bi-Bi” kinetic type with UDPglc binding first and UTP dissociating last from the enzyme. No effectors are considered (Junker, 2004).

$$V3 = v_f \frac{[UDPglc][PP] - \frac{[G1P][UTP]}{K_{eq}}}{[UDPglc][PP]\left(1+\frac{[G1P]}{K_{i,G1P}}\right) + K_{m,PP}\left([UDPglc]+K_{i,UDPglc}\right) + K_{m,UDPglc}[PP] + \frac{v_f}{v_r K_{eq}}\left[K_{m,UTP}[G1P]\left(1+\frac{[UDPglc]}{K_{i,UDPglc}}\right) + [UTP]\left\{K_{m,G1P}\left(1+\frac{K_{m,UDPglc}[PP]}{K_{i,UDPglc}K_{m,PP}}\right) + [G1P]\left(1+\frac{[PP]}{K_{i,PP}}\right)\right\}\right]}$$

Parameter	Value	Reference	Parameter	Value	Reference
v_f	1.31	Junker (2004)	$K_{m,G1P}$	0.16	Junker (2004)
v_r	0.78	”	$K_{m,UTP}$	0.142	”
K_{eq}	3.2	”	$K_{i,UDPqlc}$	0.137	”
$K_{m,UDPqlc}$	0.137	”	$K_{i,PP}$	0.127	”
$K_{m,PP}$	0.127	”	$K_{i,G1P}$	0.16	”

PGM
EC 5.4.2.2

“Uni-Uni” type reaction without inhibition (Junker, 2004).

$$V4 = v_f \frac{[G1P] - \frac{[G6P]}{K_{eq}}}{[G1P] + K_{m,G1P}\left(1+\frac{[G6P]}{K_{m,G6P}}\right)}$$

Parameter	Value	Reference	Parameter	Value	Reference
v_f	0.023	Junker (2004)	$K_{m,G1P}$	0.06	Junker (2004)
K_{eq}	19	”	$K_{m,G6P}$	0.5	”

INV EC 3.2.1.26	An irreversible Michalis-Menten mechanism with competitive inhibition by fructose and non-competitive inhibition by glucose (Junker, 2004). $$V5 = \frac{v_{\max}}{1+\frac{[Glc]}{K_{i,Glc}}} \times \frac{[Suc]}{K_{m,Suc}\left(1+\frac{[Fru]}{K_{i,Fru}}\right)+[Suc]}$$
HK EC 2.7.1.1	An irreversible random order bi-reactant mechanism (Junker, 2004). $$V6 = v_{\max}\frac{\frac{[Glc][ATP]}{K_{m,Glc}K_{m,ATP}}}{\left(1+\frac{[ATP]}{K_{m,ATP}}\right)\left(1+\frac{[Glc]}{K_{m,Glc}}+\frac{[Glc6P]}{K_{i,Glc6P}}\right)}$$
FK EC 2.7.1.4	Irreversible random-order bi-reactant kinetic, including competitive inhibition by ADP and non-competitive inhibition by Fru (Junker, 2004). $$V7 = \frac{v_{\max}}{1+\frac{[Fru]}{K_{i,Fru}}} \times \frac{\frac{[Fru][ATP]}{K_{m,Fru}K_{m,ATP}}}{1+\frac{[Fru]}{K_{m,Fru}}+\frac{[ATP]}{K_{m,ATP}}+\frac{[Fru][ATP]}{K_{m,Fru}K_{m,ATP}}+\frac{[ADP]}{K_{i,ADP}}}$$
PGI EC 5.3.1.9	"Uni-Uni" type reaction without inhibition (Junker, 2004). $$V8 = v_f\frac{[G6P]-\frac{[F6P]}{K_{eq}}}{[G6P]+K_{m,G6P}\left(1+\frac{[F6P]}{K_{m,F6P}}\right)}$$
bGly	A single reaction proceeding from Fru6P as an irreversible random order bi-reactant mechanism, including competitive inhibition by ATP (Junker, 2004). $$V9 = v_{\max}\frac{\frac{[Fru6P][ADP]}{K_{m,Fru6P}K_{m,ADP}}}{\left(1+\frac{[ADP]}{K_{m,ADP}}\right)\left(1+\frac{[Fru6P]}{K_{m,Fru6P}}+\frac{[ATP]}{K_{i,ATP}}\right)}$$

INV parameters:

Parameter	Value	Reference	Parameter	Value	Reference
v_{max}	0.015	*	$K_{i,Glc}$	31	Junker (2004)
$K_{m,Suc}$	41	Junker (2004)	$K_{i,Fru}$	0.01	”

HK parameters:

Parameter	Value	Reference	Parameter	Value	Reference
v_{max}	0.015	Junker (2004)	$K_{m,ATP}$	0.185	Junker (2004)
$K_{m,Glc}$	0.13	”	$K_{i,G6P}$	4.1	”

FK parameters:

Parameter	Value	Reference	Parameter	Value	Reference
V_{max}	0.058	Junker (2004)	$K_{i,Fru}$	5.9	Junker (2004)
$K_{m,Fru}$	0.077	”	$K_{i,ADP}$	0.078	”
$K_{m,ATP}$	0.026	”			

PGI parameters:

Parameter	Value	Reference	Parameter	Value	Reference
v_f	0.041	Junker (2004)	$K_{m,F6P}$	0.15	Junker (2004)
K_{eq}	2	”	$K_{m,G6P}$	0.27	”

bGly parameters:

Parameter	Value	Reference	Parameter	Value	Reference
v_{max}	0.1	*	$K_{m,ADP}$	0.018	Junker (2004)
$K_{m,F6P}$	0.14	Junker (2004)	$K_{i,ATP}$	0.21	”

SPS
EC 2.4.1.14

A reversible ordered bi-reactant mechanism, with UDP-glucose binding first and UDP dissociating last from the enzyme; Pi was modeled as a competitive inhibitor with respect to Fru6P (Junker, 2004).

$$V10 = v_f \frac{[Fru6P][UDPglc] - \frac{[Suc6P][UDP]}{K_{eq}}}{[Fru6P][UDPglc]\left(1+\frac{[Suc6P]}{K_{i,Suc6P}}\right) + K_{m,Fru6P}\left(1+\frac{[Pi]}{K_{i,Pi}}\right)\left([UDPglc]+K_{i,UDPglc}\right) + K_{m,UDPglc}[Fru6P] + \frac{v_f}{v_r K_{eq}} \times \left[[Suc6P]K_{m,UDP}\left(1+\frac{[UDPglc]}{K_{i,UDPglc}}\right) + [UDP]\left\{K_{m,Suc6P}\left(1+\frac{K_{m,UDPglc}[Fruc6P]}{K_{i,UDPglc}K_{m,Fru6P}\left(1+\frac{[Pi]}{K_{i,Pi}}\right)}\right) + [Suc6P]\left(1+\frac{[Fru6P]}{K_{i,Fru6P}}\right)\right\}\right]}$$

Parameter	Value	Reference	Parameter	Value	Reference
v_f	0.0077	Junker (2004)	$K_{m,S6P}$	0.41	Junker (2004)
v_r	0.0041	”	$K_{i,S6P}$	0.07	”
K_{eq}	10	”	$K_{i,F6P}$	0.14	”
$K_{m,F6P}$	0.3	”	$K_{i,Pi}$	3	”
$K_{m,UDPglc}$	4.6	”	$K_{i,UDPglc}$	1.4	*
$K_{m,UDP}$	0.3	”			

SPP
EC 3.1.3.24

An irreversible Michaelis-Menten mechanism with non-competitive inhibition by sucrose (Junker, 2004).

$$V11 = v_{\max} \frac{[Suc6P]}{\left[K_{m,Suc6P}\left(1+\frac{[Suc]}{K_{i,Suc}}\right) + [Suc6P]\left(1+\frac{[Suc]}{K_{i,Suc}}\right)\right]}$$

Parameter	Value	Reference	Parameter	Value	Reference
v_{max}	0.0025	Junker (2004)	$K_{i,Suc}$	41	Junker (2004)
$K_{m,S6P}$	0.1	”			

ATPcons

Balancing Pi in cytosol

$$V12 = 28V_{bGly} - V_{SPP} - V_{G6PT}$$

ATP:UDP phospho-transferase (EC 2.7.4.6)

A reversible mass action (Assmus, 2005)

$$V13 = v_{\max}\left(k_f[ATP_{cyt}][UDP_{cyt}] - k_r[ADP_{cyt}][UTP_{cyt}]\right)$$

Parameter	Value	Reference	Parameter	Value	Reference
v_{max}	1	*	k_r	0.1	*
k_f	0.1	*			

G6PT

A reversible mass action

$$V14 = v_{\max}\left(k_f[G6P_{cyt}][Pi_{amp}] - k_r[G6P_{amp}][Pi_{cyt}]\right)$$

Parameter	Value	Reference	Parameter	Value	Reference
v_{max}	0.01	Assmus (2005)	k_r	0.1	Assmus (2005)
k_f	0.1	”			

pPGM
EC 5.4.2.2

“Uni-Uni” type reaction without inhibition

$$V15 = v_f \frac{[G6P] - \frac{[G1P]}{K_{eq}}}{[G6P] + K_{m,G6P}\left(1+\frac{[G1P]}{K_{m,G1P}}\right)}$$

Parameter	Value	Reference	Parameter	Value	Reference
v_f	0.023	Junker (2004)	$K_{m,G6P}$	0.5	Junker (2004)
K_{eq}	0.053	Calculated by $1/K_{eq}^{PGM}$	$K_{m,G1P}$	0.06	”

AGPase EC 2.7.7.27

The “ordered Bi-Bi” kinetic type with ATP binding first and ADPglc dissociating last from the enzyme with activation by 3-phosphoglyceric acid (3PGA) and inhibition by Pi (Kleczkowski et al., 1993; Assmus, 2005).

$$V16 = v_{app}\frac{[ATP][G1P]-\dfrac{[PP][ADPglc]}{K_{eq}}}{[ATP][G1P]\left(1+\dfrac{[PP]}{K_{i,PP}}\right)+K_{m,G1P}\left([ATP]+K_{i,ATP}\right)+K_{m,ATP}[G1P]+\dfrac{v_f}{v_r K_{eq}}\left[K_{m,ADPglc}[PP]\left(1+\dfrac{[ATP]}{K_{i,ATP}}\right)+[ADPglc]\left\{K_{m,PP}\left(1+\dfrac{K_{m,ATP}[G1P]}{K_{i,ATP}K_{m,G1P}}\right)+[PP]\left(1+\dfrac{[G1P]}{K_{i,G1P}}\right)\right\}\right]}$$

$$v_{app} = v_f\left(\frac{1+\dfrac{3PGA}{K_{a,3PGA}}}{1+\dfrac{Pi}{K_{i,Pi}}}\right)$$

Parameter	Value	Reference	Parameter	Value	Reference
v_f	2.53E-6	Sowokinos and Preiss (1982)	$K_{i,G1P}$	0.14	*
v_r	3.24E-5	Sowokinos (1981)	$K_{m,G1P}$	0.14	Sowokinos and Preiss (1982)
K_{eq}	1	Assmus (2005)	$K_{m,PP}$	0.10	Sowokinos and Preiss (1982)
$K_{i,PP}$	0.00038	Amir and Cherry (1972)	$K_{i,ATP}$	0.19	
$K_{m,ADPglc}$	0.24	Sowokinos (1981)	$K_{a,3PGA}$	0.01	Assmus (2005)
$K_{m,ATP}$	0.19	Sowokinos and Preiss (1982)	$K_{i,Pi}$	0.16	Assmus (2005)

GBSS EC 2.4.1.242

To represent GBSS reaction, there were two sub-reactions lumped together as follows:

i. ADP-Glc separation sub-reaction used an irreversible uni-uni Michaelis-Menten mechanism, where Glc_a was Glc residue for GBSS reaction.

ADPglc_amp → Glc_a + ADP_amp

$$V17.1 = v_{\max}\frac{[ADPglc]}{K_{m,ADPglc}+[ADPglc]}$$

Parameter	Value	Reference	Parameter	Value	Reference
v_{max}	6E-7	*	$K_{m,ADPglc}$	1.3	Edwards et al. (1999)

ii. Glc polymerization sub-reaction used a mass action law. The number of Glc residues (Glc_a) used in the polymerization into AL_amp was assumed to be 5000, which was in the range of 1000 – 10,000 (Blennow et al., 1998).

5000 Glc_a → AL_amp

$$V17.2 = kDP[Glc_a]$$

Parameter	Value	Reference
kDP	10	*

SS
EC 2.4.1.21

To respresent SS reaction, there were two sub-reactions lumped together as follows:

i. ADP-Glc separation sub-reaction used an irreversible uni-uni Michaelis-Menten mechanism, where Glc_b was Glc residue for SS reaction.

ADPglc_amp → Glc_b + ADP_amp

$$V18.1 = v_{\max} \frac{[ADPglc]}{K_{m,ADPglc} + [ADPglc]}$$

Parameter	Value	Reference	Parameter	Value	Reference
v_{max}	1.75E-7	*	$K_{m,ADPglc}$	0.07	Edwards et al. (1999)

ii. Glc polymerization sub-reaction used a mass action law. The number of Glc residues (Glc_b) used in the polymerization into LG_amp was assumed to be 21 that was in the range of 20 – 25 (Blennow et al., 1998).

21 Glc_b → LG_amp

$$V18.2 = kDP[Glc_b]$$

Parameter	Value	Reference
kDP	10	*

SBE
EC 2.4.1.18

An irreversible uni-uni Michaelis-Menten mechanism

$$V19 = v_{\max} \frac{[LG]}{K_{m,LG} + [LG]}$$

Parameter	Value	Reference	Parameter	Value	Reference
v_{max}	6.2E-9	*	$K_{m,LG}$	0.13	Blennow et al. (1998)

DBE
EC 3.2.1.41

An irreversible uni-uni Michaelis-Menten mechanism

$$V20 = v_{\max} \frac{[PG]}{K_{m,PG} + [PG]}$$

Parameter	Value	Reference	Parameter	Value	Reference
v_{max}	1.868E-5	Hussain et al. (2003)	$K_{m,PG}$	0.37	Wu et al. (2002)

ATPT

A reversible mass action.

$$V21 = v_{\max}\left(k_f [ATP_{cyt}][ADP_{amp}] - k_r [ATP_{amp}][ADP_{cyt}]\right)$$

Parameter	Value	Reference	Parameter	Value	Reference
v_{max}	0.001	*	k_r	0.002	Assmus (2005)
k_f	0.002	”			

iPPtase
EC 3.6.1.1

A near-equilibrium (Assmus, 2005)

$$V22 = v_{\max}\left(1 - \frac{[Pi]}{K_{eq}[PP]}\right)$$

Parameter	Value	Reference	Parameter	Value	Reference
v_{max}	8.3333E-6	Assmus (2005)	K_{eq}	750000	Assmus (2005)

PiT

Balancing Pi in amyloplast

$$V23 = 2V_{iPPtase} - V_{G6PT}$$

Note: All v_{max}, v_f, and v_r are given in mM·sec^{-1} and all K_m and K_i are given in mM.

* The value of parameter was arbitrarily determined so that the simulation was compromised to reach the steady state and be closed to the literature data.

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Supplementary Table 3. Starch content and AC% from the perturbation of dual parameters

Dual parameter		starch content (mg/L) from each cases of parameter change				AC% (% w/w) from each case of parameter change			
		(-50%,-50%)	(-50%,100%)	(100%,-50%)	(100%,100%)	(-50%,-50%)	(-50%,100%)	(100%,-50%)	(100%,100%)
$v_{max}^{iPPtase}$	$K_{m,ADPglc}^{SS}$	245.53	239.56	394.68	354.45	18.70	26.01	21.45	31.35
$v_{max}^{iPPtase}$	v_{max}^{SS}	238.15	245.98	334.01	415.88	27.86	17.99	36.92	16.55
$v_{max}^{iPPtase}$	$K_{m,ADPglc}^{GBSS}$	244.08	242.24	393.52	361.24	26.27	18.64	33.36	19.99
$v_{max}^{iPPtase}$	$K_{a,PGA3}^{AGPase}$	247.92	238.59	390.27	346.09	21.84	21.70	26.67	24.53
$v_{max}^{iPPtase}$	k_f^{ATPT}	242.08	243.37	319.08	407.16	21.75	21.77	23.55	27.64
$v_{max}^{iPPtase}$	v_{max}^{ATPT}	242.09	243.36	319.19	407.05	21.75	21.77	23.56	27.64
$v_{max}^{iPPtase}$	v_f^{AGPase}	238.28	248.07	343.46	390.30	21.70	21.84	24.41	26.67
$v_{max}^{iPPtase}$	$K_{i,Pi}^{AGPase}$	238.82	247.02	348.18	388.47	21.70	21.82	24.62	26.57
$v_{max}^{iPPtase}$	k_f^{G6PT}	240.36	244.74	345.65	393.05	21.71	21.80	24.51	26.82
$v_{max}^{iPPtase}$	v_{max}^{GBSS}	242.24	244.11	360.55	394.91	18.61	26.39	19.72	33.97
$K_{m,ADPglc}^{SS}$	v_{max}^{SS}	302.45	319.93	289.47	312.47	28.84	14.08	37.99	20.82
$K_{m,ADPglc}^{SS}$	$K_{m,ADPglc}^{GBSS}$	316.45	313.75	308.63	296.69	23.41	15.50	35.96	22.78
$K_{m,ADPglc}^{SS}$	$K_{a,PGA3}^{AGPase}$	320.20	305.38	306.86	293.50	18.82	18.55	28.97	28.35
$K_{m,ADPglc}^{SS}$	k_f^{ATPT}	308.73	316.11	290.83	305.16	18.61	18.73	28.21	28.89
$K_{m,ADPglc}^{SS}$	v_{max}^{ATPT}	308.79	316.10	290.92	305.14	18.61	18.73	28.22	28.89
$K_{m,ADPglc}^{SS}$	v_f^{AGPase}	304.37	320.32	292.56	306.92	18.54	18.82	28.30	28.97
$K_{m,ADPglc}^{SS}$	$K_{i,Pi}^{AGPase}$	306.11	319.42	294.22	306.32	18.56	18.80	28.38	28.94
$K_{m,ADPglc}^{SS}$	k_f^{G6PT}	308.83	317.67	293.08	307.32	18.60	18.76	28.32	28.99
$K_{m,ADPglc}^{SS}$	v_{max}^{GBSS}	313.73	316.49	296.41	308.96	15.45	23.57	22.53	36.40
v_{max}^{SS}	$K_{m,ADPglc}^{GBSS}$	306.20	284.48	317.85	316.65	39.53	27.16	20.88	14.10
v_{max}^{SS}	$K_{a,PGA3}^{AGPase}$	300.36	287.94	322.92	307.28	33.53	32.33	16.64	16.78
v_{max}^{SS}	k_f^{ATPT}	283.65	299.56	311.84	318.08	31.89	33.47	16.73	16.67
v_{max}^{SS}	v_{max}^{ATPT}	283.73	299.54	311.89	318.07	31.90	33.47	16.73	16.67
v_{max}^{SS}	v_f^{AGPase}	287.08	300.41	306.25	323.06	32.25	33.54	16.79	16.64
v_{max}^{SS}	$K_{i,Pi}^{AGPase}$	288.61	299.88	308.02	322.01	32.39	33.49	16.77	16.65
v_{max}^{SS}	k_f^{G6PT}	286.35	301.77	311.65	319.50	32.17	33.68	16.73	16.66
v_{max}^{SS}	v_{max}^{GBSS}	283.65	306.74	316.64	317.87	26.80	39.96	14.08	21.00
$K_{m,ADPglc}^{GBSS}$	$K_{a,PGA3}^{AGPase}$	317.95	303.34	311.17	297.86	29.50	28.80	18.62	18.45
$K_{m,ADPglc}^{GBSS}$	k_f^{ATPT}	305.52	314.33	297.26	308.86	28.90	29.32	18.45	18.59
$K_{m,ADPglc}^{GBSS}$	v_{max}^{ATPT}	305.60	314.31	297.35	308.84	28.91	29.32	18.45	18.59
$K_{m,ADPglc}^{GBSS}$	v_f^{AGPase}	302.33	318.06	296.91	311.24	28.75	29.51	18.44	18.62
$K_{m,ADPglc}^{GBSS}$	$K_{i,Pi}^{AGPase}$	304.07	317.23	298.56	310.60	28.83	29.46	18.46	18.61
$K_{m,ADPglc}^{GBSS}$	k_f^{G6PT}	306.05	316.03	298.68	310.81	28.92	29.41	18.46	18.62
$K_{m,ADPglc}^{GBSS}$	v_{max}^{GBSS}	309.58	316.15	304.71	309.83	22.85	36.88	15.48	23.29
$K_{a,PGA3}^{AGPase}$	k_f^{ATPT}	306.04	316.20	289.80	302.80	23.03	23.36	22.56	22.92
$K_{a,PGA3}^{AGPase}$	v_{max}^{ATPT}	306.10	316.19	289.91	302.78	23.03	23.36	22.56	22.92
$K_{a,PGA3}^{AGPase}$	v_f^{AGPase}	309.55	316.98	275.54	310.12	23.14	23.39	22.21	23.16
$K_{a,PGA3}^{AGPase}$	$K_{i,Pi}^{AGPase}$	310.27	316.56	279.46	308.78	23.16	23.37	22.30	23.11
$K_{a,PGA3}^{AGPase}$	k_f^{G6PT}	308.80	317.94	283.54	306.35	23.11	23.42	22.40	23.03
$K_{a,PGA3}^{AGPase}$	v_{max}^{GBSS}	311.08	318.11	297.80	303.46	18.49	29.81	18.35	29.06

k_f^{ATPT}	v_{max}^{ATPT}	261.40	309.71	309.77	312.05	22.09	23.14	23.14	23.22
k_f^{ATPT}	v_f^{AGPase}	288.68	306.10	301.91	316.31	22.53	23.03	22.90	23.36
k_f^{ATPT}	$K_{i,Pi}^{AGPase}$	290.65	305.41	303.45	315.51	22.58	23.01	22.94	23.34
k_f^{ATPT}	k_f^{G6PT}	289.15	307.42	305.40	314.27	22.54	23.07	23.00	23.29
k_f^{ATPT}	v_{max}^{GBSS}	297.17	305.71	308.78	314.45	18.34	29.18	18.47	29.62
v_{max}^{ATPT}	v_f^{AGPase}	288.79	306.17	301.89	316.29	22.53	23.03	22.90	23.36
v_{max}^{ATPT}	$K_{i,Pi}^{AGPase}$	290.75	305.48	303.43	315.49	22.58	23.01	22.94	23.34
v_{max}^{ATPT}	k_f^{G6PT}	289.28	307.47	305.37	314.26	22.55	23.07	23.00	23.29
v_{max}^{ATPT}	v_{max}^{GBSS}	297.25	305.78	308.76	314.44	18.34	29.18	18.47	29.62
v_f^{AGPase}	$K_{i,Pi}^{AGPase}$	277.27	308.31	310.42	316.62	22.25	23.10	23.17	23.38
v_f^{AGPase}	k_f^{G6PT}	281.52	305.69	308.89	318.06	22.35	23.01	23.12	23.43
v_f^{AGPase}	v_{max}^{GBSS}	296.85	302.44	311.15	318.22	18.34	29.01	18.50	29.82
$K_{i,Pi}^{AGPase}$	k_f^{G6PT}	285.04	306.82	308.00	317.21	22.43	23.05	23.09	23.40
$K_{i,Pi}^{AGPase}$	v_{max}^{GBSS}	298.50	304.19	310.51	317.38	18.36	29.10	18.49	29.77
k_f^{G6PT}	v_{max}^{GBSS}	298.59	306.21	310.73	316.14	18.36	29.20	18.49	29.71

Note: The highlighted cells in red and green represent the top three highest values and the bottom three lowest values, respectively.