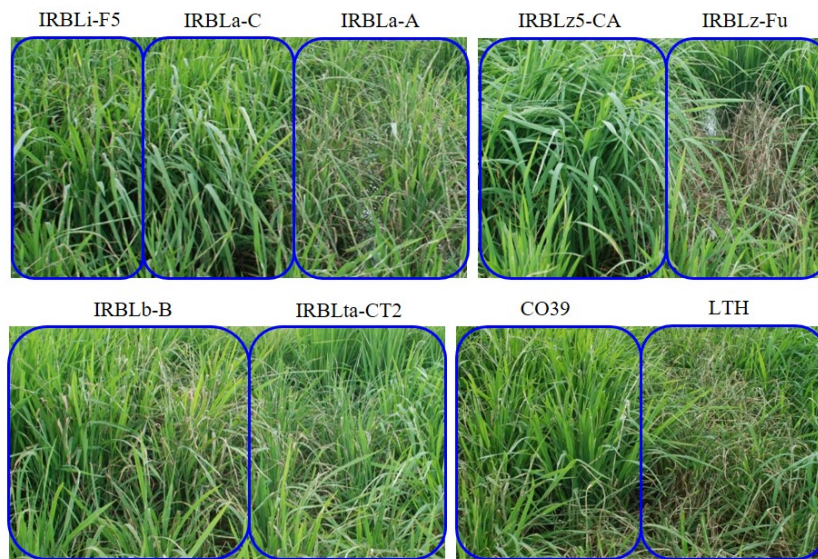


Supplementary Fig. 1. Evaluation method of percentage of diseased leaf area to rice blast in the paddy field by Notteghem (1993).



Supplementary Fig. 2. Disease incidence of leaf blast of monogenic lines in the paddy field in Jeonju, 2020.

Supplementary Table 1. Information of DNA markers linked to 20 resistance genes to blast in this study.

R gene	Marker	Chr.	For-seq	Rev-seq	Tm (°C)	Size (bp)	Reference
Pish/Pi35	Pish-ID007	1	tacaccgctcggtttcacc	atgcccctcgtgcagcc	55	(100) sh, 35	Kitazawa et al. 2019
	Pish-ID010	1	tgctacatatatgataattgctgagg	tcaatctacaccgttagatcat	50	(94) sh, (81) 35	Kitazawa et al. 2019
	Pish-ID011	1	agcacttgacactccacagcag	ggcaaaacccgtgttctgagc	55	(102) sh, (116) 35	Kitazawa et al. 2019
pit	tdDN	1	ggaaaaatagagtgcaaacgcc	ccttctgatgtttttctatataagc	60	142 (pit)	Hayashi et al. 2010
Pit	tdDK	1	gtgccacgtgctgccttcccgttg	ccttctgatgtttttctatataagc	60	362 (Pit)	Hayashi et al. 2010
Pib	NSb	2	atcaactctgccacaaaatcc	cccatacaccactgttccccc	57	620	Cho et al. 2007
	Pibdom	2	gaacaatgcccaacttgaga	gggtccacatgtcagtgagc	55	365	Fjellstrom et al. 2004
Piz/Piz-t	zt4792	6	tatatattggcgaggtaggac	agtgtgtgctgcagctgctttg	60	292	Hayashi et al. 2004
	zt6057	6	gaagctcaactaggaaactgacgc	actggaagctccctctatagccc	60	356	Hayashi et al. 2004
	Piz-ID18	6	ctgctcctaccgtttggaagtc	ctcctggccccacgcgtc	55	(98) z-t, z-5, 9, (84) z	Kitazawa et al. 2019
	Piz-ID22	6	atgtgggtttctgattccaat	cttgattagtgagatccattgtcc	55	(127) z, (100) z-t, z-5, (118) 9	Kitazawa et al. 2019
	Piz-PA	6	atgtggatgctgtgttat	tagttgctgctcaataagta	62	176	Su et al. 2020
Pi9	Pi9STS2	6	tgctgactgcttctattcgt	gtactctatctgagcgacgcaa	53/45	1120	Qu et al. 2006
	F9	6	tgattatgtttttatgtgggg	attagtggatccattgttcc	55	140	Qu et al. 2006
	PB9-1	6	tagactcctccaagttgact	tgtgatttcagaatttctgt	60	180	Gandeka et al. 2015
	Pi9	6	gctgtgctccaaatgaggat	gcgatctcacatcttttct	60	R-291/S-397	Xu et al. 2013
pi21	pi21-InDel	4	gatcctcatcgtcagctctggc	agggtacggcaccagcttg	60	R-200/S-290	Angeles-Shim et al. 2020
Pi40	9871.T7E	6	ccatcccatctgaaacctgc	ccccaggctgctgataccttc	68	300 (Mlu CI)	Jeung et al. 2007
Pigm	S29742	6	cagtgaacgaacgctatg	aataggaaggttgatgttg	56	R-555/S-461	Deng et al. 2006
	ZJ58.7-6	6	acttgctgggagaaggatt	agtctgacttttcaggct	55	210	Yu et al. 2013
	Pigm-2	6	tctgaattattgtgctcgtg	ccgtcacatcagttttct	60		Zeng et al. 2018
	Pigm-4	6	atgctcgattcgttacatt	cgtcccacattctttt	60		Zeng et al. 2018
Pii/Pi3	JJ80-T3	9	ttatgagattaggagtgtat	atgtaaaggcaaaactgat	57	442	Yi et al. 2004
	JJ113-T3	9	ctctggtgatctttgttac	ggatgatgtgatctgcagag	57	484	Yi et al. 2004
Pi5	JJ817	9	gatatggtgaaaagctaactca	atcattgctcttattcagagt	60	1450	Cho et al. 2007
Pia	Pia-STS	11	cttttgactgattggtctgc	ctattgcaccagaggaccag	65	120	Okuyama et al. 2011
	yca72	11	aggagaagaagccaccaagg	gagctgccacatctcctt	60	635 (Hinf I)	Cho et al. 2007
Pb1	Pb1-1	11	atcaacgctacctccc	gtgccatcaaatcttctc	55	159	Sun et al. 2016
Pik-multiple family alleles	Dkm1	11	ctggagagcttccgtgac	tctcagcagctcaatggggc	60	223	
	Dkm2	11	gttttactcctctactactacgc	ttctcctgctatcagcaacg	60	291	
	Ckm1	11	tgagctcaaggcaaaagtgagg	tgtccaactcactgatgag	56	174/213	Costanzo & Jia 2010
	Ckm2	11	cagtagctgtgctcagaactatg	aaggtacctttttcgccag	60	290/332	
	Pik-ID001	11	cttttagcctccagattgca	tcattgtcatcaaaatgggcta	55	(100) k, k-h, 7, 1, (88) k-m, k-p, k-s	Kitazawa et al. 2019
	Pik-ID007	11	aacgaatattatgactaaagaaagt	agaagcttgactccgttag	55	(120) k, (406) k-m, k-p, k-s, k-h, 7, 1	
	Pik-ID011	11	ggftaaataggactccctcta	gcatccaatagaatcagaga	55	(169) k, k-m, k-s, 1, (150) k-p, k-h, 7	
Pik-ID014	11	ttcttttatcccgtcttct	atgaggaaaacgaagatgagag	55	(344) k, k-p, k-h, 7, (150) k-m, k-s, 1		
Pik-p	Pikp1	11	gcagctcagccaagcaat	caaccgtgttttgcctcc	60	759 (MseI)	Zhai et al. 2011
Pi54	Pikh-1	11	caatcccaaagtttcagg	gcttcaactactgctagacc	55	R-216/S-359	Ramkumar et al. 2011
Pi65(t)	SNP-3	11	tgcccaccgcaatcttcaacat	accacatcactcagccatcc	55	R-947/S-928	Zheng et al. 2016
	InDel-1	11	atcttacctcaacattgcc	agacatgttgaagagcct	55	200	Zheng et al. 2016
Pi19(t)	Pita-2-ID009	12	cacatagcattagagcactaaact	aacctatcaccggcctattta	55	(102) 19 or ta-2	Kitazawa et al. 2019
	Pita-2-ID011	12	tgcaattagtctggtgttga	acatgaatcagctgagctcat	55	(115) 19, (85) ta-2	
Pita/Pita-2	YL155/YL87	12	agcaggttataagctaggcc	ctaccaacaagttcatcaa	55	Pita allele-1042	Jia et al. 2004
	YL183/YL87	12	agcaggttataagctagctat	ctaccaacaagttcatcaa	55	pita allele-1042	

Supplementary Table 2. Cultivation areas in 2019 of rice varieties used in this study.

Variety	Area (ha)	%	Areas in cultivation regions (ha)																
			Kyeonggi	Kangwon	Chungbuk	Chungnam	Jeonbuk	Jeonnam	Kyeongbuk	Kyeongnam	Jeju	Seoul	Busan	Daegu	Incheon	Kwangju	Daejeon	Ulsan	Sejong
Chucheong	53,911	7.4	33,308	964	12,165	891.3	3	1	316	4,431	0	89	2	0.5	1,702.0	0	0	19	20
Odae	16,573	2.3	588	14,205	1,599	8.1	33	0	130	6	0	0	3	1.2	0	0	0	0	0
Ilpum	53,970	7.4	20	0	26	10.1	1	0	53,426	15	0	0	0	471	0	0	0	0	0
Daeam	5,982	0.8	4,824	1,1580	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hmi	6,503	0.9	0	0	0	57.8	91	6,331	1	22	0	0	0	0	0	0	0	0	0
Dongjinchal	22,002	3.0	338	22	263	4,078.1	10,174	4,356	813	1,272	0	5	81	62	80	276	65	67	49
Sindongjin	135,192	18.5	10	100	0	1,682.6	75,875	55,107	0.4	2	0	0	5	0.0	168	2,237	5	0	0
Samkwang	111,847	15.3	10,032	4,493	8,061	56,715.4	56	1,168	22,710	253	0	0	4	358	5,078	0	349	5	2,564
Unkwang	17,054	2.3	31	745	166	2,817.8	4,373	1,511	2,159	4,707	0	0	96	287	9	15	15	10	112
Gopum	14	0.0	11	0	0	0.0	0	0	2	0	0	0.4	0	0	0	0	0	0	0
Hopum	2,889	0.4	23	13	1,201	710.0	126	497	249	55	0	0	5	0	0	0	0	0	10
Chilbo	159	0.0	4	3	0	48.6	10	22	50	21	0	0	1	0	0	0	0	0	0
Saenuri	40,057	5.5	3	0	10	17,044.3	10,575	2,571	4,955	3,890	0	0	209	435	257	0	9	0	99
Hwanggeumnodeul	7,452	1.0	31	0	3,369	3,650.1	127	113	107	10	0	0	6	0	0	0	0	0	40
Haiami	3,492	0.5	199	423	1,007	67.1	153	320	1,069	175	0	0.9	1	68	9	0	0	1.2	0
Jinsumi	333	0.0	1	0	266	5.7	0	20	16	24	0	0	0	0	0	0	0	0	0
Baegokchal	7,315	1.0	213	9	140	459.7	154	3,053	2,018	817	0	0	58	208	4.4	166	5	1.2	10
Yeonghojinmi	26,293	3.6	207	0	0	43.4	26	5,103	729	18,082	0	0	632	3	00	20	0	1,448	0
Jopyeong	7,638	1.0	220	14	6	223.1	1,505	1,355	1,590	2,064	0	0	18	443	160	40	0	0	0
Mipum	6,727	0.9	20	0	1	3,125.7	1,475	2,059	7	5	3.2	0	0	0	0	20	0	1.5	10
Sukwang	1,172	0.2	0	8	9	70.4	172	373	0	529	0	0	0	0	0	0	0	0	10
Daebo	2,760	0.0	0	41	1,868	294.9	44	141	202	44	0	4	10	0	42	0	0	0	69
Saeilmi	83,298	11.4	1	0	0	11,373.9	1,329	40,220	1	25,533	0	0	292	0	30	2,050	70	2,220	148
Hyeonpum	797	0.1	0	0	0	215.8	6	564	0	9	0	0	0	0	0	0	0	0	2
Chindeul	12,112	1.7	0	0	0	10,596.6	3	60	3	138	0	0	0	0	472	0	446	0	395
Haepum	2,720	0.4	11	0	0	79.5	179	478	519	1,259	0	0	40	62	3	2	0.0	67	20
Haedamssal	3,338	0.0	72	0	8	273.8	401	96	1,820	576	0	0	5	65	0	0	19	0	2.3
Cheongpum	373	0.1	6	0	6	357.7	0.1	0	0	0.3	0	0	0	0	3	0	0	0	0
Jinkwang	756	0.0	2	708	3	1.3	8	0	32	0	0	0	0	0	0.8	0	0	0	0
Haedeul	120	0.0	118	0	0	0.0	2	0	0	0	0	0	0	0	0	0	0	0	0
Yechan	170	0.0	0	0	0	7.5	91	52	9	11	0	0	0	0	0	0	0	0	0
Saecheongmu	15,537	0.0	0	0	0	19.3	5	15,299	0	13	0	0	0	0	0	201	0	0	0
Koshihikari	11,269	1.5	8,955	0	244	135.8	125	261	241	5	0	9	1.5	79	1,213	0	0	0.3	0
Subtotal	659,823	90.4	59,247	22,908	30,419	115,066	107,122	141,162	93,175	63,967	3.2	108	1,468	2,541	9,230	5,026	983	3,839	3,559
Total	729,820	100	76,644	28,640	33,247	132,174	112,146	154,091	97,465	65,983	45.1	1238	2,335	2,752	10,23	5,026	1,074	3,897	3,943

Supplementary Table 3. Mean incidences of blast nursery screening to monogenic lines in eight regions from 2009 to 2020.

Lines	R gene	Years of blast nursery screening												Mean±SD
		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
IRBLa-A	Pia	8.5	8.4	8.0	7.3	7.4	7.5	7.5	7.5	7.2	6.1	7.3	8.6	7.6±0.69
IRBLi-F5	Pii	8.8	8.3	7.5	7.1	7.5	6.9	7.4	7.3	6.9	5.8	7.3	7.4	7.4±0.73
IRBLks-F5	Pik-s	8.3	7.2	7.4	6.5	6.9	6.5	6.9	6.4	6.2	6.1	6.1	6.1	6.7±0.67
IRBLks-S	Pik-s	7.9	5.5	5.6	6.2	5.5	5.4	5.4	5.2	5.8	4.3	4.9	6.0	5.6±0.87
IRBLk-Ka	Pik	6.5	8.1	7.5	5.0	6.1	6.6	7.6	6.5	7.3	6.2	5.9	5.6	6.6±0.91
IRBLkp-K60	Pik-p	8.2	7.7	6.5	6.5	5.6	6.4	6.5	5.1	5.5	4.6	3.8	4.4	5.9±1.32
IRBLkh-K3	Pik-h	7.6	5.9	4.9	6.1	5.2	4.6	4.9	5.0	4.5	3.3	3.2	4.1	4.9±1.21
IRBLkm-Ts	Pik-m	5.3	3.6	3.1	3.5	3.1	2.8	3.5	4.2	3.8	4.2	2.0	2.9	3.5±0.84
IRBLz-Fu	Piz	6.5	3.8	3.1	4.7	6.3	6.1	6.2	6.9	8.1	7.3	7.5	8.0	6.2±1.59
IRBLz5-CA	Piz-5	4.6	3.2	2.7	3.0	3.5	3.1	4.5	4.7	4.7	3.0	3.4	3.5	3.7±0.75
IRBLzt-T	Piz-t	3.3	3.1	2.6	3.6	3.4	2.2	2.7	2.2	3.4	2.4	2.1	2.6	2.8±0.54
IRBLta-K1	Pita	3.2	6.3	4.7	2.5	5.2	5.7	6.6	5.9	5.9	3.4	5.0	3.8	4.9±1.34
IRBLta-CT2	Pita	7.1	7.0	5.8	5.4	6.6	6.2	7.3	6.4	6.4	5.3	4.8	6.6	6.2±0.78
IRBLta-CP1	Pita	7.2	2.9	2.4	3.9	3.6	2.1	2.6	2.5	2.7	1.7	2.0	2.6	3.0±1.46
IRBLta2-Re	Pita-2	6.0	6.8	5.9	3.9	5.8	6.2	7.4	6.6	6.1	5.1	5.5	5.9	5.9±0.88
IRBLta2-Pi	Pita-2	3.5	4.8	3.5	6.5	4.7	4.5	5.0	3.5	3.9	3.8	2.5	3.1	4.1±1.06
IRBLb-B	Pib	7.7	8.0	6.7	6.3	6.8	6.9	7.5	6.3	6.5	6.1	5.4	6.4	6.7±0.73
IRBLt-K59	Pit	7.6	5.2	3.2	6.6	4.3	4.1	4.4	3.9	5.0	3.1	3.3	4.8	4.6±1.36
IRBLsh-S	Pish	7.4	6.4	4.7	3.3	6.2	5.3	5.4	6.6	5.9	4.8	4.7	5.9	5.6±1.09
IRBLsh-B	Pish	6.9	6.5	4.9	6.1	4.7	4.3	5.3	5.9	4.1	3.3	2.5	4.0	4.9±1.33
IRBL1-CL	Pi1	6.6	5.5	3.4	5.6	5.7	5.3	3.5	5.3	6.8	5.6	5.5	5.0	5.3±1.01
IRBL3-CP4	Pi3	5.6	7.3	6.5	4.5	5.9	5.6	5.6	6.5	5.4	4.8	4.2	4.6	5.5±0.92
IRBL5-M	Pi5	6.5	5.2	4.2	6.5	4.8	6.4	4.8	6.2	6.4	5.4	6.1	6.4	5.7±0.82
IRBL7-M	Pi7	5.0	6.1	5.5	4.6	4.4	3.9	6.4	6.0	4.3	5.5	4.5	4.6	5.1±0.81
IRBL9-W	Pi9	6.4	3.5	3.7	5.4	4.1	2.5	3.9	3.0	3.2	2.0	3.3	3.3	3.7±1.20
IRBL11-Zh	Pi11	4.5	7.5	7.4	2.9	6.2	6.9	6.8	5.2	4.8	4.1	3.4	4.5	5.4±1.57
IRBL12-M	Pi12	6.1	5.2	4.6	6.6	5.0	4.1	3.9	3.5	3.5	3.7	3.3	3.5	4.4±1.10
IRBL19-A	Pi19	7.0	4.9	3.3	4.5	6.3	3.9	4.6	3.2	4.2	3.8	3.3	3.0	4.3±1.25
IRBL20-IR24	Pi20	7.8	3.3	2.5	3.9	2.7	2.5	2.4	1.6	2.4	1.8	1.9	2.4	2.9±1.66
LTH	Non	6.5	6.7	7.4	2.5	7.2	6.6	7.6	6.9	7.4	6.2	6.4	7.4	6.6±1.36

Supplementary Table 4. Results of blast nursery test of japonica leading rice varieties across regions and years.

Years	Regions of blast nursery test								Mean	STD
	Yeosu (Icheon)	Suwon	Cheolwon	Jeonju (Iksan)	Milyang	Sangju	Yesan	Naju		
2009	7.5	5.2	4.3	6.1	6.7	5.2	5.2	7.4	5.9	1.16
2010	5.1	4.2	3.3	5.2	6.2	4.3	6.0	4.8	4.9	0.95
2011	4.2	3.7	4.3	5.3	5.9	4.6	6.5	5.0	4.9	0.93
2012	4.2	2.3	4.5	4.5	4.5	4.4	4.8	2.5	3.9	0.98
2013	2.9	2.5	4.7	4.7	5.4	6.0	6.3	2.8	4.4	1.50
2014	1.6	1.8	2.7	3.6	4.7	3.4	3.8	1.7	2.9	1.15
2015	5.7	4.0	6.4	5.4	5.9	5.3	3.1	2.6	4.8	1.39
2016	3.8	3.8	6.1	5.0	3.6	5.4	1.8	3.6	4.1	1.32
2017	-	3.2	3.6	4.7	5.0	3.3	4.2	2.2	3.7	0.98
2018	1.5	2.8	1.4	4.7	4.8	4.4	2.0	1.6	2.9	1.51
2019	2.9	5.2	2.5	3.9	5.2	5.2	2.1	2.5	3.7	1.35
2020	3.6	4.3	6.1	5.1	4.9	4.0	6.1	3.8	4.7	0.97
Mean±SD	3.9±1.76	3.6±1.10	4.2±1.55	4.9±0.66	5.2±0.84	4.6±0.81	4.3±1.76	3.4±1.69		

Supplementary Table 5. Mean incidences of blast nursery screening to japonica leading rice varieties in eight regions from 2009 to 2020.

Varieties	Line no.	Years	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean±SD
Chucheong	-	(1970)	8.0	7.0	7.5	5.4	7.1	2.6	6.4	5.8	6.7	6.6	6.4	7.6	6.4±1.41
Odae	Suweon303	1980	6.0	5.4	4.6	4.0	3.0	2.8	4.0	3.0	2.1	2.3	3.4	2.9	3.6±1.22
Ilpum	Suweon355	1990	6.6	5.8	6.0	4.1	5.0	4.6	5.9	3.9	3.9	5.1	5.1	5.3	5.1±0.88
Daean	Suweon396	1994	5.3	5.1	4.0	3.4	4.6	5.6	4.8	3.5	3.3	3.1	2.6	4.1	4.1±0.96
Ilmi	Milyang122	1995	3.6	3.3	2.3	2.9	2.5	2.1	3.1	2.3	2.0	2.1	1.9	2.3	2.5±0.56
Dongjinchal	Iksan425	1998	7.1	5.5	5.5	5.0	5.7	3.9	6.1	5.8	5.0	4.5	3.5	4.5	5.2±1.00
Sindongjin	Iksan438	1999	5.5	4.6	3.8	4.6	3.1	2.5	4.3	2.8	3.3	2.6	3.5	3.0	3.6±0.94
Samkwang	Suweon474	2003	6.0	4.4	4.4	3.3	2.8	3.6	4.0	3.5	3.3	1.4	2.9	3.9	3.6±1.11
Unkwang	Unbong30	2004	4.0	3.5	2.8	2.6	2.7	4.4	3.1	3.3	3.9	1.5	2.5	2.9	3.1±0.78
Gopum	Suweon479	2004	3.6	2.5	2.3	1.9	1.9	1.5	3.6	3.4	2.7	1.5	2.5	2.6	2.5±0.75
Hopum	Iksan480	2006	7.0	5.5	5.0	4.0	4.6	1.9	4.8	3.1	2.9	2.0	4.1	4.9	4.1±1.49
Chilbo	Yeongdeog44	2007	8.1	6.5	7.1	5.3	5.9	2.9	6.4	5.6	4.3	3.3	2.8	5.6	5.3±1.71
Saenuri	Iksan486	2007	7.3	4.8	6.6	5.9	4.7	3.1	5.6	5.1	5.0	2.9	4.8	5.8	5.1±1.26
Hwanggeumnodeul	Iksan488	2007	6.3	4.6	4.8	4.1	4.3	1.9	4.5	3.8	2.7	1.9	3.0	5.3	3.9±1.33
Haiami	Suweon511	2008	7.0	6.9	7.0	6.0	6.6	3.3	6.8	7.0	6.4	5.6	6.5	7.0	6.3±1.06
Jinsumi	Milyang218	2008	6.0	5.8	5.4	5.0	4.5	2.8	5.3	4.8	3.3	1.1	3.8	5.9	4.5±1.47
Baegokchal	Milyang225	2008	5.3	3.6	4.3	4.3	4.2	2.9	3.9	3.6	3.6	2.5	3.5	4.5	3.8±0.73
Yeonghojinmi	Milyang228	2009	8.1	7.4	7.8	5.1	7.8	5.0	7.4	6.9	7.1	6.9	6.0	7.6	6.9±1.03
Jopyeong	Unbong42	2010	2.9	1.4	2.9	1.4	2.6	2.6	2.9	2.1	2.1	1.3	1.6	1.5	2.1±0.65
Mipum	Iksan505	2010	7.5	5.6	5.5	4.5	6.5	4.6	6.9	6.1	6.1	5.5	6.8	6.4	6.0±0.89
Sukwang	Iksan520	2011	5.3	4.1	4.4	2.9	4.7	1.3	4.8	4.5	3.0	2.0	2.6	4.4	3.6±1.26
Daebo	Yeongdeog51	2011	5.9	5.8	5.5	3.5	4.9	1.6	5.0	5.1	3.4	2.1	4.1	2.1	4.1±1.51
Saeilmi	Milyang244	2011	4.4	4.3	1.9	2.5	3.5	1.3	2.6	3.3	1.4	1.3	2.8	2.3	2.6±1.08
Hyeonpum	Iksan527	2012	-	7.3	7.3	5.4	6.8	1.8	5.9	6.1	6.0	6.4	7.3	8.1	6.2±1.68
Chindeul	Iksan529	2012	-	4.3	4.3	3.0	3.4	1.5	4.8	3.8	3.4	2.0	3.0	4.1	3.4±0.99
Haepum	Iksan537	2013	-	-	6.5	3.9	5.3	4.7	5.0	4.3	3.9	3.3	4.4	4.4	4.5±0.90
Haedamssal	Milyang275	2014	-	-	-	3.3	2.6	2.4	4.0	1.6	3.4	1.4	3.3	3.0	2.8±0.86
Cheongpum	Suweon567	2015	-	-	-	-	4.8	3.3	4.6	4.4	2.7	2.0	2.8	5.1	3.7±1.16
Jinkwang	Suweon575	2016	-	-	-	-	-	3.4	4.8	4.8	2.7	2.8	3.5	5.0	3.8±0.98
Haedeul	Suweon588	2017	-	-	-	-	-	-	3.5	3.3	3.4	1.5	2.5	3.4	2.9±0.79
Yechan	Iksan583	2017	-	-	-	-	-	-	5.5	3.6	4.1	2.6	3.1	4.9	4.0±1.08
Koshihikari	-	(1956)	8.1	7.6	7.6	6.5	7.3	7.3	7.6	6.6	7.3	5.5	7.4	8.3	7.3±0.75