The Diversity of Isoflavone Contents and *In Vitro* Antioxidant Activities in Japanese Soybean (*Glycine max* (L.) Merr.) Cultivars

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Summary

The isoflavone contents in seeds of 217 Japanese soybean cultivars were investigated by HPLC. Total isoflavones; the sum of four chemical forms (aglycones, glucosides, malonylglucosides and acetylglucosides), varied among cultivars ranging from 142.9 mg/100g soybean seeds of Osodaizu to 1171.3 mg/ 100g of Hiroizumi Daizu, with an average content of 487.5 mg/100g seeds. Malonylglucosides were most abundant, while acetylglucosides and aglycones were present in only trace amounts in the soybean seeds. Total phenolic, total flavonoid and relative anthocyanin contents in the seeds were found maximum in Peking. Antioxidant activities of these 217 soybean cultivars were also determined by 3 different assays; β -carotene bleaching, DPPH radical scavenging and ferric reducing assays. Soybean seed extracts showed antioxidant properties which varied widely among cultivars and assays. The highest capacities to inhibit β -carotene bleaching, to scavenge DPPH radical and to act as reducing agent were found in seeds of Hiroshima Kuro Daizu, Hazenomi Daizu and Peking, respectively. Correlations between the antioxidant contents (isoflavones, phenolics, flavonoids and anthocyanins) and the antioxidant capacities in the 3 assays were observed. The results suggest that ferric reducing powers of soybeans analyzed in this study were contributed by the presence of anthocyanins. The antioxidant activities slightly correlated with contents and kind of isoflavones.

Key Words: soybean, isoflavones, β-carotene oxidation, DPPH scavenging activity, ferric reducing power

Introduction

Soybean (*Glycine max* (L.) Merr.) has been considered to be one of the world's most important food resources. It has been used in eastern Asia, especially in China and Japan, for many centuries as the source of plant protein and vegetable oil. Besides protein and oil, soybean also has several phytochemical substances. Isoflavones are an interesting group of phytochemicals found in soybeans and soy foods. They are a group of flavonoids and well known as phytoestrogen due to their structural similarity with mammalian estradiol. Health benefits of isoflavones have bean evaluated in hormone-dependent diseases. Dietary intake of soybean isoflavones has been reported to be linked to a decreased risk of cardiovascular disease, osteoporosis, breast and prostate cancer, and menopausal symptoms¹⁾.

Three isoflavones (genistein, daidzein and glycitein) are present in 4 chemical forms (aglycone, glucoside, malonylglucoside and acetylglucoside) in soybean seeds. Consequently, there are totally 12 isomers of isoflavones in soybean. An objective of this study was to determine the variation of isoflavone contents in 217 Japanese soybean cultivars.

Soy isoflavones have been reported to exhibit antioxidant properties both in vitro and in vivo. Moreover, there are several classes of other antioxidant compounds present in soybeans. Therefore, the other objective of this work was to determine the antioxidant activities of Japanese soybean cultivars in order to identify those with a higher potential to promote human health by consumption of soybeans and soy products.

Materials and Methods

1. Preparation of extracts

Soybean seeds (217 cultivars) were ground and soaked in 70% ethanol at room temperature for 24 hr in the dark with agitation. The extract was centrifuged at 3000 rpm for 10 min, filtered through 0.45 μ m syringe filter and stored at -20 \mathfrak{C} until used.

2. HPLC analysis of isoflavones

The HPLC analysis was performed according to Kudou *et al*.²⁾ using YMC-Pack ODS-AM-303 (250x4.6mm) column and an Intelligence HPLC system (Jasco) composed by an autosampler (AS-2057 Plus), pump (PU-1580), and a UV/VIS detector (UV-1570). The solvent flow rate was 1ml/min and isoflavones were detected at 260 nm. The injection volume was 10 μ l. A linear gradient of mobile phase was employed: solvent A was 15% acetonitrile and solvent B was 35% acetonitrile; both contain 0.1% phosphoric acid. Twelve isoflavone standards were purchased from LC Laboratories.

3. Total phenolic, total flavonoid and relative anthocyanin contents

Concentrations of 3 classes of antioxidant compounds present in soybeans were determined by the following methods. Total phenolic content was analyzed by Folin-Ciocalteu method according to Genovese *et al*.³⁾ with some modifications. The absorbance was measured at 700 nm. The results are expressed as gallic acid equivalent (GAE) in mg/100g soybean seeds. Total flavonoid content was determined by aluminum chloride colorimetric method⁴⁾ with some modifications. The absorbance was read at 405 nm. The results are expressed as quercetin equivalent (QE) in mg/100g of seeds. Relative anthocyanin content was determined by measuring the absorbance at 510 nm.

4. Antioxidant activity in β -carotene linoleate model system

The antioxidant activity was determined by measuring the coupled oxidation of β -carotene and linoleic acid, as described by Siddhuraju & Becker⁵⁾ with some modifications. One ml of β -carotene solution in chloroform (2 mg/10 ml) was pipetted into a round-bottom flask, which contained linoleic acid (40 mg) and Tween 40 (200 mg). After removal of the chloroform by evaporation at 45 \mathfrak{C} , 100 ml of oxygenated distilled water was added to the flask with vigorous agitation. Aliquots (250 µl) of this emulsion were placed in 96-well microplate, which contained 10 µl of the extracts. Samples were read against a blank containing the emulsion minus the β -carotene immediately at 450 nm (t = 0) and then at 15-min intervals for 180 min along with heat induction

at 50 \mathbb{C} . Antioxidant activity (AA) was calculated as percent inhibition relative to the control, using the following equation:

$$AA = \left(\frac{C (Abs0-Abs180) - S (Abs0-Abs180)}{C (Abs0-Abs180)}\right) \times 100$$

Where C and S are the control and samples, respectively, and Abs0 and Abs180 are the absorbance at 450 nm at 0 and 180 min, respectively.

5. DPPH radical scavenging activity

Free radical scavenging activity was estimated as described by Othman *et al*.⁶ with some modifications. An aliquot of the soybean seed extract (20 μ l) was mixed with 100 mM Tris-HCl buffer, pH 7.4 (80 μ l). Then 100 μ M 2,2-Diphenyl-1-picryhydrazyl (DPPH) previously prepared in ethanol (100 μ l) was added. The mixture was stored in the dark for 20 min at room temperature. Absorbance was read at 510 nm. The scavenging effect was calculated using the following equation:

Scavenging activity (%) =
$$\left(1 - \frac{\text{Abs of sample at 510 nm}}{\text{Abs of control at 510 nm}}\right) \times 100$$

6. Ferric reducing power

Ferric reducing power of soybean seed extract was determined based on the conversion of ferric ion into ferrous form according to the method of Shon *et al*.⁷. The extract (200 µl) was mixed with 1% potassium ferricyanide (500 µl) and 200 mM phosphate buffer, pH 6.6 (500 µl). The mixture was incubated in water bath at 50 \mathbb{C} for 20 min. Then 10% trichloroacetic acid (500 µl) was added and the mixture was centrifuged at 3000 rpm for 10 min. The upper layer (150 µl) was mixed with distilled water (150 µl) and 0.1% ferric chloride (30 µl). The absorbance was read at 700 nm. Ferric reducing power was calculated as percent relative to the power of 0.5 mg/ ml gallic acid (100% reducing power).

Results and Discussion

1. HPLC analysis of isoflavones in soybeans

The similar chromatogram's patterns were observed among all of the 217 cultivars (Fig. 1) but total isoflavone contents varied widely among cultivars from 142.9 mg (Osodaizu) to 1171.3 mg (Hiroizumi Daizu), with an average amount of 487.5 mg (Table 1). These values are similar to those found in Korean cultivars (188-949 mg/100g) reported by Lee *et al*.⁸⁾. In this study, soybean seeds were most abundant in malonylgenistin followed by malonyldaidzin, malonylglycitin, genistin, daidzin, and glycitin in the decreasing order (Fig. 2). The malonylglucoside form comprises almost 90% of total isoflavones. The total isoflavones are found to correlate with the content of malonylglucosides (r = 0.998; n = 215). The seeds contained only trace amount of aglycone and acetylglucoside forms of isoflavones.



Fig. 1 Chromatogram of isoflavones extracted from soybean sample; Hiroizumi Daizu.

Table 1. Antioxidant contents and	l antioxidant :	activities in	soybean extracts
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			Antioxida	nt contents		Antioxidant activities		vities
No.	Soybean cultivars	Total isoflavones	Total phenolics	Total flavonoids	Anthocyanins	%AA	%SCA	%FRP
	Japanese cultivars							
1	Abura Daizu	363.1	109.64	54.59	0.005	50.11	74.83	19.07
2	Abura Mame	366.9	86.81	56.55	0.006	59.32	73.13	21.42
3	Aka Daizu	278.9	100.47	66.06	0.030	42.19	81.03	19.91
	(Oda Denzou)							
4	Akanukanai	482.1	111.93	58.04	0.009	39.82	68.23	18.44
5	Akasaya	590.8	106.48	59.90	0.002	38.56	72.17	18.48
6	Akasaya Shouryu	739.7	142.60	69.42	0.012	32.66	77.95	20.04
7	Akatsuka	514.7	109.51	59.35	0.004	40.09	73.96	17.14
8	Akishiro	522.4	99.89	63.15	0.008	56.04	72.93	16.84
9	Akita Ani	681.8	114.10	67.42	0.008	50.43	73.72	23.31
10	Akiyoshi	680.1	96.07	57.35	0.004	52.07	66.83	15.71
11	Akiyoshi	339.2	115.21	58.99	0.016	47.67	73.04	25.69
	Kurakake							
12	Akiyoshi	422.7	131.26	70.75	0.025	45.15	81.42	23.43
	Kurakake							
	Daizu							
13	Akiyoshi	674.9	122.89	65.53	0.005	64.77	79.50	19.58
	Shiro Daizu							
14	Ao Aki Daizu	412.3	91.67	53.93	0.007	32.49	72.61	18.36
15	Ao Aki Mame	246.9	71.63	56.13	0.013	54.03	72.65	17.50
16	Ao Baka	605.7	113.64	73.95	0.012	72.25	69.44	21.42
17	Ao Ginjiro	497.4	105.28	60.15	0.014	50.55	79.20	19.65
18	Ao Mame	936.2	123.48	84.66	0.009	33.51	65.87	19.48
19	Aobata Daizu	526.6	105.54	52.93	0.016	57.14	74.00	21.28
20	Aojiro	655.3	236.98	65.55	0.008	40.59	74.13	25.07
21	Aokawa Higu	326.6	99.80	51.48	0.008	33.99	74.13	18.28
22	Aomame	266.1	98.39	38.42	0.009	39.82	72.57	14.52
	(Honbetsu)							
23	Aoroku	460.3	110.59	59.68	0.005	48.90	74.07	16.98

24	Aoyagi	163.2	75.16	39.48	0.008	45.42	73.36	16.25
25	Asajiro 1	327.2	85.47	59.15	0.004	49.58	58.81	16.78
26	Asajiro 2	379.6	86.19	45.28	0.006	43.16	63.33	17.28
27	Ashoro	619.3	123.43	63.57	0.011	19.17	77.78	20.58
28	Ban Echigo	352.8	100.62	59.75	0.010	66.67	72.83	21.74
29	Butai Dadacha	219.6	85.45	57.48	0.019	54.36	73.72	21.76
30	Chaironodaizu	534.7	105.30	57.24	0.009	22.22	69.35	15.48
31	Chajiro	341.9	84.54	48.66	0.005	36.26	79.77	21.35
32	Chakurakake	177.6	93.97	54.46	0.018	58.61	77.08	18.34
33	Chayahori	406.0	105.28	59.33	0.012	51.83	80.20	24.84
	(Edamame)							
34	Chikugo Daizu	363.2	101.26	48.99	0.006	35.08	77.97	20.03
35	Chizuka	353.3	103.18	54.82	0.008	62.91	70.63	20.64
36	Chougetsu	533.8	107.35	66.15	0.008	51.01	73.20	23.75
37	Choukouji	810.1	133.14	77.95	0.008	46.15	76.51	23.18
	Zairai							
38	Choutan Daizu	499.6	102.99	60.33	0.008	52.20	67.11	16.33
39	Chuusei Date Cha	956.9	151.87	75.48	0.023	54.06	76.03	29.45
40	Daidoumame	343.7	93.76	58.77	0.006	75.21	71.66	19.90
41	Dekisugi	840.8	129.61	74.59	0.006	48.88	73.97	26.65
42	Enomoto	773.1	122.12	77.82	0.009	47.44	71.57	21.56
43	Enrei	322.2	88.46	46.48	0.003	43.47	74.50	22.01
44	ERIMO	581.7	124.89	41.30	0.012	45.64	47.79	10.28
45	Erusuta	456.8	86.61	52.55	0.009	58.53	81.44	17.69
46	Ezonishiki	225.3	75.33	51.08	0.007	67.01	74.01	20.74
47	Fujihime	584.2	119.18	64.17	0.005	39.00	75.48	17.19
48	Fukunaga 1	321.5	105.41	57.30	0.013	59.22	71.08	23.13
49	Fukuyutaka	536.0	86.28	60.88	0.007	62.06	80.00	16.73
50	Furanomaruha	447.5	95.05	55.97	0.009	32.44	73.78	16.09
51	Gankui Mame	349.3	143.92	74.06	0.074	54.64	77.78	39.51
52	Geden Shirazu	611.7	101.58	64.44	0.006	67.35	71.07	20.68
53	Gokuaomura	401.0	78.99	54.26	0.017	64.67	67.67	17.48
54	Gokuwase Chishima	269.6	131.68	56.13	0.041	49.44	75.87	28.54
55	Gokuwase	289.2	91.63	53.75	0.012	76.19	75.36	17.84
	Hayabusa Edamame							
56	Gokuwase-	203.6	62.43	36.19	0.008	39.65	61.98	12.47
	kamishunbetsu							
57	Goyou Daizu	378.4	100.51	56.06	0.007	53.33	77.97	24.29
58	Hachihei Mame	647.6	94.31	62.26	0.015	48.72	79.06	16.88
59	Hachikoku	228.7	68.75	49.39	0.007	39.22	54.58	11.66
60	Hakubi Daizu	276.9	100.93	42.66	0.003	35.29	73.75	20.31
61	Hana Shirazu	432.9	94.22	57.39	0.004	65.82	78.35	18.21
62	Hanayome	516.3	114.19	60.37	0.006	70.09	67.11	16.77
63	Hanguro	531.3	130.12	71.30	0.032	45.57	80.91	27.31
64	Hazenomi Daizu	437.2	123.51	67.90	0.014	45.10	81.61	26.60
65	Hidaka Aodaizu	476.5	102.56	64.39	0.017	51.28	76.35	19.46
66	Higan Mame	230.0	94.51	46.86	0.005	46.11	71.11	19.97
67	Hikage Mame	468.1	127.92	66.33	0.008	64.50	72.06	26.31
68	Hikarikuro	279.8	136.93	78.13	0.060	49.02	75.17	34.86
69	Hikuandaa	235.1	100.89	43.90	0.005	29.85	77.08	21.07
70	Hiraishi	810.9	137.47	65.75	0.005	60.62	72.86	20.79
71	Hiroizumi Daizu	1171.3	138.25	89.75	0.010	54.11	72.88	22.01
72	Hirose Kuro Daizu	461.7	158.35	88.99	0.078	50.84	77.97	42.97
73	Hiroshima	362.6	144.50	72.86	0.060	85.02	72.41	35.79
	Kuro Daizu							
74	Hishiumi Zairai	495.9	109.86	62.75	0.008	30.92	59.97	13.48
75	Hitori Musume	481.1	124.88	57.99	0.011	49.15	74.51	23.72
	(Edamame)							
76	Honkurakake	272.0	130.55	63.44	0.034	57.72	76.22	30.39

77 Horokanizariani 355.1 92.55 41.59 00.008 77.14 69.79 13.13 78 Hoshino Zairai 523.8 11.85 64.99 00.008 17.21 47.32 10.86 80 Hougioku 73.0 102.28 54.90 00.006 55.22 67.84 14.26 81 Hoigiaku Kawazu 73.0 100.37 58.93 0.002 47.75 73.83 18.86 81 Kuikiname 698.4 11.400 72.24 0.009 53.73 0.022 77.73.83 18.80 83 Ichkiname 698.4 11.400 72.24 0.009 52.55 11.0 12.69 84 Ichinyuu 420.4 12.866 62.97 0.015 62.33 71.30 17.82 85 Ichon 20.96 81.11 16.85 0.001 30.73 75.86 14.63 90 90.90 82.011 30.77 75.86 14.63 90.90 91 Ishidian Shiro 41.83 10.30 64.84 0.0012 75.75<									
78 Hoshi Mame 622.2 152.28 83.75 0.040 47.01 71.90 37.32 79 Hoshino Zaini 528.3 11.85 64.99 0.008 58.22 67.84 14.24 81 Houjaku Kuwazu 586.1 106.32 67.66 0.008 93.4 45.58 11.87 82 Hyuga 712.0 106.32 67.66 0.009 50.73 78.21 22.50 84 Ichiximame 698.4 114.00 72.34 0.009 26.56 51.10 12.69 85 Iphon Sagoa 522.1 105.25 51.73 0.003 39.01 73.50 17.82 87 Ippon Suzunari 522.1 102.64 64.44 0.007 30.77 75.86 14.63 88 Ippon Suzunari 53.53 0.018 84.61 0.012 0.015 91 Ischikara 31.3 96.83 92.28 0.008 51.63 72.00 12.01 73.2	77	Horokanaizairai	355.1	92.55	41.59	0.008	37.14	69.79	13.13
79 Hoshino Zairni 528.3 111.85 64.99 0.008 17.21 47.32 10.86 80 Hougyoku 732.0 100.28 54.90 0.006 58.22 67.84 14.24 81 Hougka Kuwazu 586.1 106.32 67.66 0.003 9.34 45.58 11.87 82 Hyauga 712.0 100.97 58.93 0.002 47.75 73.83 18.98 83 Ichikimame 698.4 114.00 72.24 0.009 50.73 77.82 12.25.0 84 Ichinyau 420.4 128.66 62.97 0.015 63.03 74.10 17.31 85 Ichoa 22.1 114.11 68.55 0.013 39.45 61.40 17.31 84 Ipponsou 211.2 95.21 87.97 0.008 51.63 72.06 20.05 91 Issikari Shiro 418.8 103.30 64.88 0.012 61.08 74.16 19.09 <td>78</td> <td>Hoshi Mame</td> <td>622.2</td> <td>152.28</td> <td>83.75</td> <td>0.040</td> <td>47.01</td> <td>71.90</td> <td>37.32</td>	78	Hoshi Mame	622.2	152.28	83.75	0.040	47.01	71.90	37.32
80 Hougyoku 732.0 102.28 54.90 0.006 58.22 67.84 12.4 81 Hougka Kuwazu 58.61 106.32 67.66 0.008 9.34 45.58 11.87 82 Hyuuga 712.0 100.97 58.93 0.002 47.75 73.83 18.98 83 Ichikimame 69.44 114.00 72.24 0.009 50.73 78.21 22.30 84 Ichiyuu 420.6 12.26.6 62.07 0.015 62.33 72.30 23.70 17.82 85 Iphon Sangou 52.21 10.24.6 64.44 0.007 30.77 75.86 14.63 88 Ippon Souranti 52.12 10.24.6 64.44 0.007 30.77 75.86 14.64 19 Ishikaris 54.57 12.21.4 71.73 0.008 67.43 51.00 12.05 91 Ishikaris 54.57 12.24 71.73 0.009 65.91 71.48	79	Hoshino Zairai	528.3	111.85	64.99	0.008	17.21	47.32	10.86
81 Hougiata Kuwazu 586.1 106.32 67.66 0.008 9.34 45.58 11.87 82 Hyunga 712.0 10097 58.93 0.002 47.75 73.83 18.98 83 Ichiryuu 42.04 12.866 62.97 0.015 62.33 72.39 22.50 84 Ichiryuu 42.04 12.86 62.97 0.015 62.33 72.39 23.70 85 Ichou 20.66 81.40 49.35 0.003 39.01 73.50 17.82 87 Ikki 790.9 11.11 68.55 0.013 39.45 61.40 17.31 88 Ippon Suzunari 52.11 17.14 17.33 0.008 51.63 72.06 20.05 91 Isakiari Shiro 418.8 103.30 64.88 0.012 63.08 74.16 19.09 92 Itachikara 314.2 187.26 50.70 0.016 60.41 70.32 17.65 <	80	Hougyoku	732.0	102.28	54.90	0.006	58.22	67.84	14.24
82 Hymiga 712.0 100.97 \$8.93 0.002 47.75 73.83 18.98 83 kchikimame 698.4 114.00 72.24 0.009 \$0.73 78.21 22.50 84 kchiyuu 420.4 128.66 62.97 0.015 62.33 72.39 23.70 85 lchon Sangou 528.7 116.52 51.73 0.005 39.01 73.50 17.82 87 lkki 790.9 114.11 68.55 0.013 39.45 61.40 12.05 98 lpponsou 211.2 95.21 58.97 0.008 51.63 72.06 12.05 91 lachikara 514.7 71.21 74.73 0.009 63.08 74.16 19.09 92 lachikara 134.2 187.26 50.07 0.016 59.46 66.83 20.21 17.65 94 lzumi 235.5 103.15 48.88 0.021 61.34 71.49 19.	81	Houjaku Kuwazu	586.1	106.32	67.66	0.008	9.34	45.58	11.87
83 Ichikimame 698.4 114.00 72.24 0.009 50.73 78.21 22.50 84 Ichiryuu 420.4 128.66 62.97 0.015 62.33 72.39 23.70 85 Ichou 209.6 81.40 49.55 0.009 26.55 51.10 12.69 86 Ibhon Sangou 52.87 116.52 51.73 0.005 39.01 73.54 61.40 17.31 87 Ibki 700.9 142.11 68.55 0.013 39.45 61.40 17.31 87 Iponsou 211.2 95.21 58.97 0.008 51.63 72.06 20.05 91 Ischikara 314.2 187.26 50.70 0.016 59.24 74.3 71.65 17.69 44.20 17.65 91 Izoni 79.0 127.59 72.24 0.011 60.00 71.73 22.79 95 Jizou 79.90 127.59 72.24 0.011	82	Hyuuga	712.0	100.97	58.93	0.002	47.75	73.83	18.98
bit <	83	Ichikimame	698.4	114.00	72.24	0.009	50.73	78 21	22 50
bit bit <td>84</td> <td>Ichiryuu</td> <td>420.4</td> <td>128.66</td> <td>62.97</td> <td>0.005</td> <td>62 33</td> <td>72.39</td> <td>22.30</td>	84	Ichiryuu	420.4	128.66	62.97	0.005	62 33	72.39	22.30
bithom Sangou 220,5 01,5,5 47,2,5 0,00,5 39,01 73,50 17,82 87 Ikki 700,9 114,11 68,55 0,013 39,45 61,40 17,31 87 IpponSuzunari 522,1 102,64 64,44 0,007 30,77 57,86 14,63 89 IpponSou 211,2 95,21 58,97 0,008 21,63 72,46 20,05 90 Ise Mame 431,3 96,83 92,82 0,008 21,43 74,48 20,31 91 Ischikran 314,2 187,26 50,70 0,016 59,41 70,32 17,65 93 Izcuni 235,5 103,15 48,66 0,016 50,24 66,32 20,21 94 Izuni 235,5 103,15 48,60 0,011 80,002 76,41 70,33 19,37 95 Jizou 709,0 123,59 95,43 64,88 0,012 60,93 71,90	85	Ichou	209.6	81.40	10 35	0.009	26.56	51.10	12.69
and and bargon 53.87 110.52 51.73 0.003 39.91 73.01 17.31 87 Ikki 700.9 114.11 68.55 0.013 39.43 61.40 17.31 88 Ippon Suzuari 52.21 102.64 64.44 0.007 50.77 57.86 61.40 17.31 91 Ishikari Shiro 418.8 103.30 64.88 0.012 21.35 74.48 20.31 92 Itachikara 314.2 187.26 50.70 0.016 59.24 66.83 20.21 95 Jizou 709.0 127.59 72.24 0.011 60.00 71.32 27.77 96 Kara Marne 234.9 105.82 50.19 0.009 65.27 69.43 10.315 44.88 0.021 38.82 73.93 16.67 97 Kasaga Aodaizu 335.8 91.09 46.93 0.006 76.41 70.93 19.37 900 Kawamasan (B)	85	Ichon Sangau	209.0	116 52	49.33	0.009	20.30	72.50	17.09
bit RKI 99.03 114.11 68.33 0.013 39.43 01.40 11.43 88 Ippon Suzunari 52.21 58.97 0.008 51.63 72.06 20.05 90 Ise Mame 431.3 96.83 59.28 0.008 27.43 51.00 12.05 91 Ischikari Shiro 418.8 103.30 64.88 0.012 21.35 74.48 20.31 92 Itachi 545.7 122.14 71.73 0.009 65.02 66.83 20.21 93 Itachikara 314.2 187.26 50.70 0.016 59.41 70.32 17.65 95 Jizou 709.0 127.59 72.24 0.009 65.27 69.44 23.79 97 Kasuga Aodaizu 335.9 95.43 64.88 0.021 38.82 73.93 16.67 98 Kawamasan (B) 283.8 91.09 46.93 0.006 76.41 70.93 19.37 90 Kemame 765.1 124.01 73.22 0.007 45.44 14.43	00	ninon Sangou	J20.7	110.52	51.75	0.003	39.01	73.30	17.02
88 Ippon Suzumar 522.1 102.64 64.44 0.007 30.77 57.86 14.63 90 Ise Mame 431.3 96.83 59.28 0.008 51.63 72.06 20.05 91 Ishkari Shiro 418.8 103.30 64.88 0.012 21.35 74.48 20.31 92 Itachi 545.7 122.14 71.73 0.009 63.08 74.16 19.09 93 Itachikara 314.2 187.26 50.70 0.016 60.00 71.73 22.17 94 Izumi 235.5 103.15 48.66 0.016 60.02 71.73 22.77 95 Kamame 234.9 105.82 50.19 0.006 65.27 69.44 23.79 95 Kawamasan (B) 283.8 91.09 61.33 0.002 76.41 70.93 19.37 96 Karamane 765.1 124.01 71.22 10.36.5 88.4 0.008 56.37	8/		790.9	114.11	68.55	0.013	39.45	61.40	17.31
89 Ipponsou 211.2 95.21 58.97 0.008 21.63 72.06 20.05 90 Ise Mame 431.3 96.83 59.28 0.008 27.43 51.00 12.05 91 Ischikari 545.7 122.14 71.73 0.009 63.08 74.16 19.09 93 Itachikara 31.42 187.26 50.70 0.016 59.41 70.32 17.65 94 Izumi 235.5 103.15 48.66 0.016 59.41 70.32 17.65 95 Jizou 709.0 127.59 72.24 0.016 65.27 69.44 23.79 96 Kawamasan (B) 283.8 91.09 46.93 0.006 76.41 70.93 19.37 97 Kasaga Aodaizu 335.9 95.43 64.88 0.021 60.93 71.43 19.18 100 Ki Daizu 72.21 13.65 58.84 0.008 37.73 80.06 23.75 <td>88</td> <td>Ippon Suzunari</td> <td>522.1</td> <td>102.64</td> <td>64.44</td> <td>0.007</td> <td>30.77</td> <td>57.86</td> <td>14.63</td>	88	Ippon Suzunari	522.1	102.64	64.44	0.007	30.77	57.86	14.63
90 Ishkari Shiro 418.8 96.83 59.28 0.008 27.43 51.00 12.05 91 Ishkiri Shiro 418.8 103.30 64.88 0.012 21.35 74.48 20.31 92 Itachi 545.7 122.14 71.73 0.009 63.08 74.16 19.09 93 Itachikara 314.2 187.26 50.70 0.016 60.02 76.44 20.21 94 Izumi 235.5 95.43 64.88 0.016 65.27 69.44 23.79 97 Kasaga Aodaizu 335.9 95.43 64.88 0.021 38.82 73.93 16.67 98 Kamane 765.1 12.401 73.22 0.007 61.43 71.43 19.18 100 Ki Daizu 386.2 101.79 61.13 0.005 28.48 81.61 21.47 (Hayashi Ayako) 101 Kinusume 334.1 94.01 61.08 0.012 60.93 71.	89	Ipponsou	211.2	95.21	58.97	0.008	51.63	72.06	20.05
91 Ishikari Shiro 418.8 103.30 64.88 0.012 21.35 74.48 20.31 92 Itachi 545.7 122.14 71.73 0.009 63.08 74.16 19.09 93 Itachikara 314.2 187.26 50.70 0.016 59.41 70.32 17.65 94 Izumi 235.5 103.15 48.66 0.016 50.26 66.83 20.21 95 Kazu Mame 234.9 105.82 50.19 0.000 65.27 69.44 23.79 98 Kawamasan (B) 283.8 91.09 46.93 0.006 76.41 70.93 19.37 98 Kawamasan (B) 283.8 91.09 46.93 0.006 76.41 70.93 19.37 90 Kemame 765.1 124.01 73.22 0.007 28.48 81.61 21.47 (Hayashi Ayako) Titas 77.3 80.06 73.73 80.06 23.75 101	90	Ise Mame	431.3	96.83	59.28	0.008	27.43	51.00	12.05
92 Itachi 545.7 122.14 71.73 0.009 63.08 74.16 19.09 93 Itachikara 314.2 187.26 50.70 0.016 59.41 70.32 17.65 94 Izumi 235.5 103.15 48.66 0.016 50.26 66.83 20.21 95 Kara Mame 234.9 105.82 50.19 0.009 65.27 69.44 23.79 97 Kasuga Aodaizu 335.9 95.43 64.88 0.021 38.82 73.93 16.67 98 Kemame 765.1 124.01 71.22 0.007 61.54 71.43 19.18 100 Ki Daizu 386.2 101.79 61.13 0.005 28.48 81.61 21.47 (Hayashi Ayako) 101 61.08 0.012 60.93 71.90 19.66 102 Kin Daizu 272.2 113.65 58.84 0.008 37.73 80.06 23.75 104 Kizukuri Zairai 857.1 116.61 74.66 0.007 45.64 72.70 <td>91</td> <td>Ishikari Shiro</td> <td>418.8</td> <td>103.30</td> <td>64.88</td> <td>0.012</td> <td>21.35</td> <td>74.48</td> <td>20.31</td>	91	Ishikari Shiro	418.8	103.30	64.88	0.012	21.35	74.48	20.31
93 Itachikara 314.2 187.26 50.70 0.016 59.41 70.32 17.65 94 Izumi 235.5 103.15 48.66 0.016 50.26 66.83 20.21 95 Jizou 709.0 127.59 72.24 0.011 60.00 71.73 22.77 96 Kawamasan (B) 238.8 91.09 46.93 0.006 76.41 70.93 19.37 98 Kawamasan (B) 238.8 91.09 46.93 0.007 61.54 71.43 19.18 100 Kinusume 334.1 94.01 61.08 0.012 60.93 71.90 19.66 201 Kinusume 334.1 94.01 61.08 0.012 60.93 71.90 19.66 203 Kiyomidori 531.6 100.31 62.75 0.018 36.71 75.33 23.47 104 Kizakuri Zairai 857.1 116.61 74.66 0.007 2.16 52.28 12.24 <td>92</td> <td>Itachi</td> <td>545.7</td> <td>122.14</td> <td>71.73</td> <td>0.009</td> <td>63.08</td> <td>74.16</td> <td>19.09</td>	92	Itachi	545.7	122.14	71.73	0.009	63.08	74.16	19.09
94 Izumi 235.5 103.15 48.66 0.016 50.26 66.83 20.21 95 Jizou 709.0 127.59 72.24 0.011 60.00 71.73 22.77 96 Kara Mame 234.9 105.82 50.19 0.009 65.27 69.44 23.79 97 Kasuga Aodaizu 335.9 95.43 64.88 0.021 38.82 71.90 19.37 98 Kamamean (B) 283.8 91.09 46.93 0.006 76.41 70.93 19.37 98 Kemame 765.1 124.01 73.22 0.007 61.54 71.43 19.18 100 Kin Daizu 272.2 113.65 58.84 0.008 37.73 80.06 23.75 103 Kiyomidori 531.6 10.031 62.75 0.013 45.97 78.13 23.64 104 Kinskatagi 465.7 98.83 66.57 0.005 17.21 47.89 12.24	93	Itachikara	314.2	187.26	50.70	0.016	59.41	70.32	17.65
95 Jizou 709.0 127.59 72.24 0.011 60.00 71.73 22.77 96 Kara Mame 234.9 105.82 50.19 0.009 65.27 69.44 23.79 97 Kasuga Aodaizu 335.9 95.43 64.88 0.021 38.82 73.39 16.67 98 Kawamasan (B) 283.8 91.09 46.93 0.006 76.41 70.93 19.37 99 Kemame 765.1 124.01 73.22 0.007 61.54 71.43 19.18 100 Ki Daizu 334.1 94.01 61.08 0.012 60.93 71.90 19.66 120 Kimusume 334.1 94.01 61.08 0.012 60.93 71.90 19.66 101 Kimusume 334.1 94.01 61.08 0.012 64.93 72.70 19.17 105 Kobinkatagi 465.7 98.83 66.46 0.009 56.82 74.92 18.73	94	Izumi	235.5	103.15	48.66	0.016	50.26	66.83	20.21
96 Kara Mame 234.9 105.82 50.19 0.009 65.27 69.44 23.79 97 Kasuga Aodaizu 335.9 95.43 64.88 0.021 33.82 73.93 16.67 98 Kawamasan (B) 283.8 91.00 76.51 70.31 19.37 99 Kemame 765.1 124.01 73.22 0.007 61.54 71.43 19.18 100 Ki Daizu 386.2 101.79 61.13 0.005 28.48 81.61 21.47 (Hayashi Ayako) - - - - - 71.90 19.66 102 Kin Daizu 272.2 113.65 75.0118 36.71 75.33 23.47 104 Kizukuri Zairai 857.1 116.61 74.66 0.007 45.64 72.70 19.17 105 Koofinkatagi 465.7 98.83 66.46 0.009 58.87 76.81 23.64 107 Kotakeshu 418.7	95	Jizou	709.0	127.59	72.24	0.011	60.00	71.73	22.77
97 Kasuga Aodaizu 335.9 95.43 64.88 0.021 38.82 73.93 16.67 98 Kawamasan (B) 283.8 91.09 46.93 0.006 76.41 70.93 19.37 99 Kemame 76.1 124.01 73.22 0.007 61.54 71.43 19.18 100 Ki Daizu 386.2 101.79 61.13 0.005 28.48 81.61 21.47 (Hayashi Ayako) 71.90 19.66 11.3 0.007 45.64 72.70 19.17 103 Kiyomidori 531.6 100.31 62.75 0.018 36.71 75.33 23.47 104 Kizukuri Zairai 857.1 116.61 74.66 0.007 45.64 72.70 19.17 105 Kobinkatagi 465.7 98.83 66.47 0.013 45.97 78.13 23.64 107 Kotakeshu 418.7 86.75 55.55 0.007 22.16 75.99 23.42	96	Kara Mame	234.9	105.82	50.19	0.009	65.27	69.44	23.79
98 Kawamasan (B) 283.8 91.09 46.93 0.006 76.41 70.93 19.37 99 Kemame 765.1 124.01 73.22 0.007 61.54 71.43 19.18 100 Ki Daizu 386.2 101.79 61.13 0.005 28.48 81.61 21.47 (Hayashi Ayako)	97	Kasuga Aodaizu	335.9	95.43	64.88	0.021	38.82	73.93	16.67
Instruction Instruction <thinstruction< th=""> <thinstruction< th=""></thinstruction<></thinstruction<>	98	Kawamasan (B)	283.8	91.09	46 93	0.006	76.41	70.93	19.37
100 Ki Daizu (Hayashi Ayako) 101.79 61.13 0.005 28.48 81.61 21.47 101 Kimusume 334.1 94.01 61.08 0.012 60.93 71.90 19.66 102 Kin Daizu 272.2 113.65 58.84 0.008 37.73 80.06 23.75 103 Kiyomidori 531.6 100.31 62.75 0.018 36.71 75.33 23.47 104 Kizukuri Zairai 857.1 116.61 74.66 0.007 45.64 72.70 19.17 105 Kobinkatagi 465.7 98.83 66.46 0.009 56.82 74.92 18.73 106 Koosodefuri 409.8 118.85 66.57 0.013 45.97 78.13 23.64 107 Kotakeshu 418.7 86.75 55.55 0.007 22.16 52.28 12.29 108 Kou Andaa 278.6 101.60 45.99 0.005 17.21 47.89 12.09 109 Koucha 598.9 121.38 65.55 0.009	99	Kemame	765.1	124.01	73.22	0.007	61 54	71.43	19.18
100 Kl Dalad 360.2 101.79 01.13 0.000 26.43 61.01 21.47 101 Kimusume 334.1 94.01 61.08 0.012 60.93 71.90 19.66 102 Kin Daizu 272.2 113.65 58.84 0.008 37.73 80.06 23.75 103 Kiyomidori 531.6 100.31 62.75 0.018 36.71 75.33 23.47 104 Kizukuri Zairai 857.1 116.61 74.66 0.007 45.64 72.70 19.17 105 Kobinkatagi 465.7 98.83 66.46 0.009 56.82 74.92 18.73 106 Kosodefuri 409.8 118.85 66.57 0.013 45.97 78.13 23.64 107 Koukashu 418.7 86.75 55.55 0.007 22.16 52.28 12.24 108 Kou Andaa 278.6 101.60 45.99 0.005 17.21 47.89 12.09 110 Kuma Daizu 1 417.2 98.39 53.77 0.	100	Ki Dojzu	386.2	101.70	61.13	0.007	28.48	81.61	21.47
(Hayasin Pyako) (Hayasin Pyako) 101 Kimusume 334.1 94.01 61.08 0.012 60.93 71.90 19.66 102 Kin Daizu 272.2 113.65 58.84 0.008 37.73 80.06 23.75 103 Kiyomidori 531.6 100.31 62.75 0.018 36.71 75.33 23.47 104 Kizukuri Zairai 857.1 116.61 74.66 0.007 45.64 72.70 19.17 105 Kobinkatagi 465.7 98.83 66.46 0.009 56.82 74.92 18.73 106 Kosodefuri 409.8 118.85 65.55 0.007 12.14 78.81 12.09 108 Kou Andaa 278.6 10.160 45.99 0.005 17.21 47.89 12.99 12.99 12.99 12.99 15.99 111 Kura Daizu 1 417.2 98.39 53.77 0.005 55.45 75.00 20.59 112 </td <td>100</td> <td>(Hayashi Ayaka)</td> <td>580.2</td> <td>101.79</td> <td>01.15</td> <td>0.005</td> <td>20.40</td> <td>81.01</td> <td>21.47</td>	100	(Hayashi Ayaka)	580.2	101.79	01.15	0.005	20.40	81.01	21.47
101 Kimusume 534.1 94.01 61.08 0.012 60.93 71.90 12.06 102 Kinusume 272.2 113.65 58.84 0.008 37.73 80.06 23.75 103 Kiyomidori 531.6 100.31 62.75 0.018 36.71 75.33 23.47 104 Kizukuri Zariai 857.1 116.61 74.66 0.007 45.64 72.70 19.17 105 Kobinkatagi 465.7 98.83 66.46 0.009 56.82 74.92 18.73 106 Kosodefuri 409.8 118.85 66.57 0.013 45.97 78.13 23.64 107 Kotakeshu 418.7 86.75 55.55 0.007 22.16 52.28 12.24 108 Kuma Daizu 1 417.2 98.39 53.77 0.005 30.50 72.99 15.99 111 Kura Daizu 2 509.0 105.74 58.50 0.002 55.45 75.00 20.59 111 Kurokava Sciou 304.7 126.22 61.86	101		224.1	04.01	(1.09	0.012	(0.02	71.00	10.00
	101	Kimusume Kin Daima	334.1	94.01	50.04	0.012	00.93	/1.90	19.00
103 Kiyomidon 531.6 100.31 62.75 0.018 36.71 75.33 22.34 104 Kizukuri Zairai 857.1 116.61 74.66 0.007 45.64 72.70 19.17 105 Kobinkatagi 465.7 98.83 66.46 0.009 56.82 74.92 18.73 106 Kosodefuri 409.8 118.85 66.57 0.013 45.97 78.13 23.64 107 Kotakeshu 418.7 86.75 55.55 0.007 22.16 52.28 12.24 108 Kou Andaa 278.6 101.60 45.99 0.005 17.21 47.89 12.09 109 Koucha 598.9 121.38 65.55 0.009 58.80 76.95 23.42 110 Kuma Daizu 1 417.2 98.39 53.77 0.005 30.50 72.99 15.99 111 Kurosaya 662.7 199.98 60.84 0.006 64.59 72.86 22.33 Sanbongi	102	Kin Daizu	272.2	113.65	58.84	0.008	37.73	80.06	23.75
	103	Kıyomıdori	531.6	100.31	62.75	0.018	36.71	75.33	23.47
	104	Kizukuri Zairai	857.1	116.61	74.66	0.007	45.64	72.70	19.17
	105	Kobinkatagi	465.7	98.83	66.46	0.009	56.82	74.92	18.73
	106	Kosodefuri	409.8	118.85	66.57	0.013	45.97	78.13	23.64
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	107	Kotakeshu	418.7	86.75	55.55	0.007	22.16	52.28	12.24
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	108	Kou Andaa	278.6	101.60	45.99	0.005	17.21	47.89	12.09
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	109	Koucha	598.9	121.38	65.55	0.009	58.80	76.95	23.42
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	110	Kuma Daizu 1	417.2	98.39	53.77	0.005	30.50	72.99	15.99
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	111	Kuma Daizu 2	509.0	105.74	58.50	0.002	55.45	75.00	20.59
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	112	Kurokawa Seiou	304.7	126.22	61.86	0.051	56.64	74.13	30.58
111 Kurumimame 547.5 99.94 65.26 0.005 55.21 72.98 14.73 115 Kyousaku Shirazu 251.3 85.17 55.75 0.007 63.42 73.86 20.34 116 Kyuushirou 681.6 125.41 76.95 0.009 63.88 66.50 20.48 117 Kyuushuu 26 725.7 116.40 66.84 0.007 34.56 80.39 27.47 118 Maedamura Zairai 448.6 136.75 76.24 0.052 66.48 79.77 36.01 119 Magarikawa Zairai 364.4 150.89 64.62 0.065 42.49 71.08 39.85 120 Mansei 348.3 114.00 55.86 0.005 56.41 63.88 21.08 Ouhakushu 832.0 132.60 78.15 0.013 38.13 78.30 25.92 Midori Meaka 117.25 64.44 0.006 45.05 62.39 15.81 124 Menka Daizu 586.2 103.89 65.08 0.006 42.19 <td< td=""><td>113</td><td>Kurosava</td><td>662.7</td><td>199.98</td><td>60.84</td><td>0.006</td><td>64.59</td><td>72.86</td><td>22.33</td></td<>	113	Kurosava	662.7	199.98	60.84	0.006	64.59	72.86	22.33
114 Kurumimame 547.5 99.94 65.26 0.005 55.21 72.98 14.73 115 Kyousaku Shirazu 251.3 85.17 55.75 0.007 63.42 73.86 20.34 116 Kyuushirou 681.6 125.41 76.95 0.009 63.88 66.50 20.48 117 Kyuushuu 26 725.7 116.40 66.84 0.007 34.56 80.39 27.47 118 Maedamura Zairai 448.6 136.75 76.24 0.052 66.48 79.77 36.01 119 Magarikawa Zairai 364.4 150.89 64.62 0.065 42.49 71.08 39.85 120 Mansei 348.3 114.00 55.86 0.005 56.41 63.88 21.08 Ouhakushu 832.0 132.60 78.15 0.013 38.13 78.30 25.92 Midori Meaka 117.25 64.44 0.006 45.05 62.39 15.81 124	110	Sanbongi	00217	177170	00.01	01000	01107	/2.00	22.00
115 Kurummane 547.3 57.44 55.75 0.007 63.42 73.86 20.34 115 Kyousaku Shirazu 251.3 85.17 55.75 0.007 63.42 73.86 20.34 116 Kyuushirou 681.6 125.41 76.95 0.009 63.88 66.50 20.48 117 Kyuushirou 681.6 125.41 76.95 0.007 34.56 80.39 27.47 118 Maedamura Zairai 448.6 136.75 76.24 0.052 66.48 79.77 36.01 119 Magarikawa Zairai 364.4 150.89 64.62 0.065 42.49 71.08 39.85 120 Mansei 348.3 114.00 55.86 0.005 56.41 63.88 21.08 Ouhakushu 832.0 132.60 78.15 0.013 38.13 78.30 25.92 Midori Meaka 117.25 64.44 0.006 45.05 62.39 15.81 124 Menka Daizu 586.2 103.89 65.08 0.006 42.19 6	114	Kurumimame	547.5	99 94	65.26	0.005	55 21	72 98	14 73
115 Ryotsaku shinazu 251.5 351.7 55.75 0.007 65.42 75.80 20.34 116 Kyuushirou 681.6 125.41 76.95 0.009 63.88 66.50 20.48 117 Kyuushirou 681.6 125.41 76.95 0.009 63.88 66.50 20.48 117 Kyuushirou 26 725.7 116.40 66.84 0.007 34.56 80.39 27.47 118 Maedamura Zairai 364.4 150.89 64.62 0.065 42.49 71.08 39.85 120 Mansei 348.3 114.00 55.86 0.005 56.41 63.88 21.08 Ouhakushu 832.0 132.60 78.15 0.013 38.13 78.30 25.92 Midori Meaka 117.25 64.44 0.006 45.05 62.39 15.81 124 Maru Shouryuu 900.1 137.35 82.26 0.012 59.48 76.56 23.22 123 Matsuzukuri 415.1 117.25 64.44 0.006 45.05<	115	Kuousaku Shirazu	251.3	85.17	55 75	0.005	63 42	73.86	20.34
116 Kyuushindu 681.6 123.41 76.93 0.009 63.88 66.30 20.46 117 Kyuushuu 26 725.7 116.40 66.84 0.007 34.56 80.39 27.47 118 Maedamura Zairai 448.6 136.75 76.24 0.052 66.48 79.77 36.01 119 Magarikawa Zairai 364.4 150.89 64.62 0.065 42.49 71.08 39.85 120 Mansei 348.3 114.00 55.86 0.005 56.41 63.88 21.08 Ouhakushu 832.0 132.60 78.15 0.013 38.13 78.30 25.92 Midori Meaka 72.27 116.40 66.86 0.012 59.48 76.56 23.22 123 Matsuzukuri 415.1 117.25 64.44 0.006 45.05 62.39 15.81 124 Menka Daizu 586.2 103.89 65.08 0.006 42.19 68.20 13.99 125 Midoridaizu 529.4 94.42 66.86 0.017 25	115	Kyousaku Siinazu Kyousakinou	231.3	125 41	76.05	0.007	62.99	75.80 66 5 0	20.34
117 Kydushul 26 723.7 116.40 66.84 0.007 54.56 80.39 27.47 118 Maedamura Zairai 448.6 136.75 76.24 0.052 66.48 79.77 36.01 119 Magarikawa Zairai 364.4 150.89 64.62 0.065 42.49 71.08 39.85 120 Mansei 348.3 114.00 55.86 0.005 56.41 63.88 21.08 Ouhakushu 832.0 132.60 78.15 0.013 38.13 78.30 25.92 Midori Meaka 900.1 137.35 82.26 0.012 59.48 76.56 23.22 123 Maru Shouryuu 900.1 137.35 82.26 0.012 59.48 76.56 23.22 123 Matsuzukuri 415.1 117.25 64.44 0.006 45.05 62.39 15.81 124 Menka Daizu 586.2 103.89 65.08 0.006 42.19 68.20 13.99 125 Midoridaizu 529.4 94.42 66.86 0.017 <td< td=""><td>110</td><td>Kyuushirou Kaasa ahaa 26</td><td>081.0</td><td>123.41</td><td>76.93</td><td>0.009</td><td>03.88</td><td>80.30</td><td>20.48</td></td<>	110	Kyuushirou Kaasa ahaa 26	081.0	123.41	76.93	0.009	03.88	80.30	20.48
118 Maedamura Zairai 448.6 136.75 76.24 0.052 66.48 79.77 36.01 119 Magarikawa Zairai 364.4 150.89 64.62 0.065 42.49 71.08 39.85 120 Mansei 348.3 114.00 55.86 0.005 56.41 63.88 21.08 Ouhakushu 832.0 132.60 78.15 0.013 38.13 78.30 25.92 Midori Meaka 122 Maru Shouryuu 900.1 137.35 82.26 0.012 59.48 76.56 23.22 123 Matsuzukuri 415.1 117.25 64.44 0.006 45.05 62.39 15.81 124 Menka Daizu 586.2 103.89 65.08 0.006 42.19 68.20 13.99 125 Midoridaizu 529.4 94.42 66.86 0.017 25.74 43.02 11.52 126 Miharu Daizu 408.2 104.26 54.10 0.011 33.56	11/	Kyuusnuu 26	125.1	116.40	00.84	0.007	34.56	80.39	27.47
119 Magarikawa Zairai 364.4 150.89 64.62 0.065 42.49 71.08 39.85 120 Mansei 348.3 114.00 55.86 0.005 56.41 63.88 21.08 0uhakushu 832.0 132.60 78.15 0.013 38.13 78.30 25.92 Midori Meaka 71.08 39.85 25.92 9.011 137.35 82.26 0.012 59.48 76.56 23.22 123 Matsuzukuri 415.1 117.25 64.44 0.006 45.05 62.39 15.81 124 Menka Daizu 586.2 103.89 65.08 0.006 42.19 68.20 13.99 125 Midoridaizu 529.4 94.42 66.86 0.017 25.74 43.02 11.52 126 Miharu Daizu 408.2 104.26 54.10 0.011 33.56 71.88 16.10 127 Mikuni 307.2 85.51 57.86 0.006 24.68 50.19 10.69 128 Minoaka Daizu 360.7 83.89	118	Maedamura Zairai	448.6	136.75	76.24	0.052	66.48	79.77	36.01
120 Mansei 348.3 114.00 55.86 0.005 56.41 63.88 21.08 0uhakushu 832.0 132.60 78.15 0.013 38.13 78.30 25.92 Midori Meaka 900.1 137.35 82.26 0.012 59.48 76.56 23.22 123 Matsuzukuri 415.1 117.25 64.44 0.006 45.05 62.39 15.81 124 Menka Daizu 586.2 103.89 65.08 0.006 42.19 68.20 13.99 125 Midoridaizu 529.4 94.42 66.86 0.017 25.74 43.02 11.52 126 Miharu Daizu 408.2 104.26 54.10 0.011 33.56 71.88 16.10 127 Mikuni 307.2 85.51 57.86 0.006 24.68 50.19 10.69 128 Minoaka Daizu 360.7 83.89 57.48 0.007 48.52 71.46 13.61 129 Misaki Daizu 293.1 106.72 47.30 0.005 42.48	119	Magarikawa Zairai	364.4	150.89	64.62	0.065	42.49	71.08	39.85
Ouhakushu 832.0 132.60 78.15 0.013 38.13 78.30 25.92 121 Manshuu 832.0 132.60 78.15 0.013 38.13 78.30 25.92 122 Maru Shouryuu 900.1 137.35 82.26 0.012 59.48 76.56 23.22 123 Matsuzukuri 415.1 117.25 64.44 0.006 45.05 62.39 15.81 124 Menka Daizu 586.2 103.89 65.08 0.006 42.19 68.20 13.99 125 Midoridaizu 529.4 94.42 66.86 0.017 25.74 43.02 11.52 126 Miharu Daizu 408.2 104.26 54.10 0.011 33.56 71.88 16.10 127 Mikuni 307.2 85.51 57.86 0.006 24.68 50.19 10.69 128 Minoaka Daizu 360.7 83.89 57.48 0.007 48.52 71.46 13.61 <	120	Mansei	348.3	114.00	55.86	0.005	56.41	63.88	21.08
121 Manshuu 832.0 132.60 78.15 0.013 38.13 78.30 25.92 122 Maru Shouryuu 900.1 137.35 82.26 0.012 59.48 76.56 23.22 123 Matsuzukuri 415.1 117.25 64.44 0.006 45.05 62.39 15.81 124 Menka Daizu 586.2 103.89 65.08 0.006 42.19 68.20 13.99 125 Midoridaizu 529.4 94.42 66.86 0.017 25.74 43.02 11.52 126 Miharu Daizu 408.2 104.26 54.10 0.011 33.56 71.88 16.10 127 Mikuni 307.2 85.51 57.86 0.006 24.68 50.19 10.69 128 Minoaka Daizu 360.7 83.89 57.48 0.007 48.52 71.46 13.61 129 Misaki Daizu 293.1 106.72 47.30 0.005 42.48 71.84 18.04 130 Miso Mame 400.8 100.93 59.90		Ouhakushu							
Midori Meaka122Maru Shouryuu900.1137.3582.260.01259.4876.5623.22123Matsuzukuri415.1117.2564.440.00645.0562.3915.81124Menka Daizu586.2103.8965.080.00642.1968.2013.99125Midoridaizu529.494.4266.860.01725.7443.0211.52126Miharu Daizu408.2104.2654.100.01133.5671.8816.10127Mikuni307.285.5157.860.00624.6850.1910.69128Minoaka Daizu360.783.8957.480.00748.5271.4613.61129Misaki Daizu293.1106.7247.300.00542.4871.8418.04130Miso Mame400.8100.9359.900.00946.1173.6521.23131Misuzudaizu383.970.4353.040.00647.9380.5222.23	121	Manshuu	832.0	132.60	78.15	0.013	38.13	78.30	25.92
122Maru Shouryuu900.1137.3582.260.01259.4876.5623.22123Matsuzukuri415.1117.2564.440.00645.0562.3915.81124Menka Daizu586.2103.8965.080.00642.1968.2013.99125Midoridaizu529.494.4266.860.01725.7443.0211.52126Miharu Daizu408.2104.2654.100.01133.5671.8816.10127Mikuni307.285.5157.860.00624.6850.1910.69128Minoaka Daizu360.783.8957.480.00748.5271.4613.61129Misaki Daizu293.1106.7247.300.00542.4871.8418.04130Miso Mame400.8100.9359.900.00946.1173.6521.23131Misuzudaizu383.970.4353.040.00647.9380.5222.23		Midori Meaka							
123Matsuzukuri415.1117.2564.440.00645.0562.3915.81124Menka Daizu586.2103.8965.080.00642.1968.2013.99125Midoridaizu529.494.4266.860.01725.7443.0211.52126Miharu Daizu408.2104.2654.100.01133.5671.8816.10127Mikuni307.285.5157.860.00624.6850.1910.69128Minoaka Daizu360.783.8957.480.00748.5271.4613.61129Misaki Daizu293.1106.7247.300.00542.4871.8418.04130Miso Mame400.8100.9359.900.00946.1173.6521.23131Misuzudaizu383.970.4353.040.00647.9380.5222.23	122	Maru Shouryuu	900.1	137.35	82.26	0.012	59.48	76.56	23.22
124Menka Daizu586.2103.8965.080.00642.1968.2013.99125Midoridaizu529.494.4266.860.01725.7443.0211.52126Miharu Daizu408.2104.2654.100.01133.5671.8816.10127Mikuni307.285.5157.860.00624.6850.1910.69128Minoaka Daizu360.783.8957.480.00748.5271.4613.61129Misaki Daizu293.1106.7247.300.00542.4871.8418.04130Miso Mame400.8100.9359.900.00946.1173.6521.23131Misuzudaizu383.970.4353.040.00647.9380.5222.23	123	Matsuzukuri	415.1	117.25	64.44	0.006	45.05	62.39	15.81
125Midoridaizu529.494.4266.860.01725.7443.0211.52126Miharu Daizu408.2104.2654.100.01133.5671.8816.10127Mikuni307.285.5157.860.00624.6850.1910.69128Minoaka Daizu360.783.8957.480.00748.5271.4613.61129Misaki Daizu293.1106.7247.300.00542.4871.8418.04130Miso Mame400.8100.9359.900.00946.1173.6521.23131Misuzudaizu383.970.4353.040.00647.9380.5222.23	124	Menka Daizu	586.2	103.89	65.08	0.006	42.19	68.20	13.99
126 Miharu Daizu 408.2 104.26 54.10 0.011 33.56 71.88 16.10 127 Mikuni 307.2 85.51 57.86 0.006 24.68 50.19 10.69 128 Minoaka Daizu 360.7 83.89 57.48 0.007 48.52 71.46 13.61 129 Misaki Daizu 293.1 106.72 47.30 0.005 42.48 71.84 18.04 130 Miso Mame 400.8 100.93 59.90 0.006 47.93 80.52 22.23 131 Misuzudaizu 383.9 70.43 53.04 0.006 47.93 80.52 22.23	125	Midoridaizu	529.4	94 42	66.86	0.017	25 74	43.02	11.52
120 Mikuui 307.2 85.51 57.86 0.006 24.68 50.19 10.69 127 Mikuui 307.2 85.51 57.86 0.006 24.68 50.19 10.69 128 Minoaka Daizu 360.7 83.89 57.48 0.007 48.52 71.46 13.61 129 Misaki Daizu 293.1 106.72 47.30 0.005 42.48 71.84 18.04 130 Miso Mame 400.8 100.93 59.90 0.009 46.11 73.65 21.23 131 Misuzudaizu 383.9 70.43 53.04 0.006 47.93 80.52 22.23	126	Miharu Daizu	408.2	104.26	54 10	0.011	33 56	71.88	16.10
127 Mixaii 507.2 60.01 57.80 60.000 24.66 50.19 10.69 128 Minoaka Daizu 360.7 83.89 57.48 0.007 48.52 71.46 13.61 129 Misaki Daizu 293.1 106.72 47.30 0.005 42.48 71.84 18.04 130 Miso Mame 400.8 100.93 59.90 0.009 46.11 73.65 21.23 131 Misuzudaizu 383.9 70.43 53.04 0.006 47.93 80.52 22.23	120	Mikuni	307.2	85 51	57.86	0.011	24.68	50.10	10.10
126 Minoaka Daizu 500.7 65.69 57.48 0.007 46.52 71.40 15.01 129 Misaki Daizu 293.1 106.72 47.30 0.005 42.48 71.84 18.04 130 Miso Mame 400.8 100.93 59.90 0.009 46.11 73.65 21.23 131 Misuzudaizu 383.9 70.43 53.04 0.006 47.93 80.52 22.23	127	Minoska Dojzu	3607	83.01	57.00	0.000	48 50	71 46	13 41
129 Inisan Daizu 293.1 100.72 47.30 0.005 42.48 71.84 18.04 130 Miso Mame 400.8 100.93 59.90 0.009 46.11 73.65 21.23 131 Misuzudaizu 383.9 70.43 53.04 0.006 47.93 80.52 22.23	120	Migolzi Dojzy	202.1	05.09	J1.40 47.20	0.007	40.32	71.40	12.01
150 Miso Mame 400.8 100.95 59.90 0.009 46.11 /3.65 21.23 131 Misuzudaizu 383.9 70.43 53.04 0.006 47.93 80.52 22.23	129	Misa Manua	293.1	100.72	47.30	0.005	42.48	71.84	16.04
151 Misuzudaizu 383.9 /0.43 53.04 0.006 47.93 80.52 22.23	130	Miso Mame	400.8	100.93	59.90	0.009	46.11	/ 5.65	21.23
	_131	Misuzudaizu	383.9	70.43	53.04	0.006	47.93	80.52	22.23

132	Mitama	454.8	101.26	58.86	0.011	50.09	58.41	13.11
133	Mitsu Mame	1123.1	132.65	93.19	0.009	58.46	75.04	20.54
134	Miyashiro	518.9	121.32	59.10	0.010	50.73	76.21	23.22
135	Mochi Mame	473.1	90.27	54.86	0.006	56.65	73.49	22.47
136	Mumou Hadaka	228.1	84.67	45.04	0.010	57.67	71.08	22.39
137	Murasaki No Mi	476.6	114.05	56.77	0.009	66.36	70.92	21.23
138	Murayutaka	436.0	72.12	50.82	0.005	56.99	77.78	17.26
139	Mushi Shirazu (1)	309.8	99.66	52.88	0.006	73.33	73.72	21.03
140	Nadeshiko	354.2	83.56	50.66	0.005	60.28	72.06	19.45
141	Nagon	570.9	116.52	66.15	0.013	68.37	68.46	21.26
142	Narisuke	352.6	89.15	47.42	0.010	38.61	72.36	17.53
143	Nishitsugaru	472.3	95.62	58.06	0.008	46.63	72.54	20.74
144	Zairaishu	904 5	100 75	60.04	0.011	52.15	76.50	29.50
144	Nourin I	804.5	128.75	68.84 75.75	0.011	22.71	/6.50	28.59
145		574.9	134.05	15.15	0.011	25.71	70.91	21.12
140	Ogasawara Zairai	508.4	110.55	57.04 46.15	0.006	65.47 52.20	/1.3/	17.97
147	Olio Marie	524.2 202.1	00.10 05.25	40.15	0.012	55.50 60.25	66.40	10.00
148	Okullara Dalzu	393.1 700.2	95.55	30.19 71.64	0.010	20.02	55 04	19.15
149	Oomaiira	709.3	106.45	/1.04	0.008	39.03 44.07	40.42	12.54
150	Oono Zairai	293.8	101.72	40.79	0.003	53.80	49.42	23.41
151	Ootomo	437.0 627.1	100.30	67.48	0.008	56.75	66.51	18 33
152	Ootsuru	464.1	95 21	60.08	0.003	68.82	76.00	23.65
154	Ootsuura	319.0	108 25	55.64	0.011	55.44	66.03	16.86
155	Oraku Mame	518.7	111.67	59.42	0.001	54.03	76.06	21.75
155	Osodaizu	142.9	106.89	44 66	0.000	44.23	62.64	12 74
150	Otofuke	550.7	123.01	62 97	0.005	28.86	75 76	21.67
107	Kurakake	550.7	125.01	02.97	0.000	20.00	15.10	21.07
158	Rankoshi	790.7	124.22	85.10	0.010	44.88	72.57	20.77
159	Rokugatsu Daizu	606.8	104.30	76.99	0.014	47.44	68.30	17.82
160	Rvokushoku	544.3	145.74	56.88	0.008	31.26	61.11	16.40
	shasei							
161	Sachiyutaka	532.8	101.50	51.64	0.005	54.99	80.39	19.55
162	Sagamidori 4	593.6	93.56	53.10	0.011	45.78	78.04	17.40
163	Sagi Shiro	576.3	114.15	64.59	0.009	32.49	81.42	17.36
	Daizu							
164	Saishuutou	372.8	78.45	56.35	0.006	24.68	37.04	10.25
	Shirokotsubu							
165	Satou Daizu	683.1	141.05	74.68	0.009	35.04	75.00	27.38
166	Satouirazu	668.9	121.01	69.86	0.003	56.43	75.33	23.74
167	Senbirishu	271.1	102.93	45.93	0.005	48.77	66.78	15.66
168	Sennari	785.6	131.54	74.46	0.004	56.07	74.45	21.81
	Musume							
169	Shibetsunagaha	420.6	103.51	51.15	0.014	32.44	69.27	16.26
170	Shichigatsu Mame	510.8	144.47	84.33	0.070	70.64	69.52	41.37
171	Shichigou	382.0	85.51	57.82	0.010	27.22	36.97	9.26
	Cha Mame							
172	Shimokusano	581.1	107.64	63.13	0.009	50.00	78.49	20.64
173	Shimoshirazu	425.8	99.61	59.50	0.009	51.16	72.88	20.65
174	Shin Tamanishiki	314.6	96.94	56.39	0.010	54.40	76.21	21.38
175	Shinroku	557.3 249.0	129.90	67.99	0.011	46.98	/1./3	22.77
170	Shiratama	548.0	106.73	62.86	0.007	26.94	57.30	14.14
1//	Shira Daim	5/0.9	90.98	67.06	0.005	08.21 52.50	/1.45	21.20
1/8	Shiro Dalzu Shiro Conlari	040.8	110.80	67.10	0.005	53.59	80.46 74 44	19.82
1/9	Shiro Zairai	215.1	129.09	55 00	0.008	03.30	70.11	24.33
180	Shirohana	313.1 182.0	03.22 106.67	51.88 51.81	0.005	40.31	70.11	10.30
101	Shirohana	402.0 504.0	112 51	54.84 64.10	0.007	28.08	74.74 77.05	20.05
104	Oosodefuri	574.0	112.31	04.10	0.010	20.70	11.75	20.05
	COSOGETUTI							

183 Shirosaya 318.0 110.72 46.48 0.004 33.12 77.08 18.97 184 Shokuyou 573.2 109.62 61.50 0.006 51.05 68.95 16.86 Aki Daizu									
184 Shokuyou 573.2 109.62 61.50 0.006 51.05 68.95 16.86 Aki Daizu	183	Shirosaya	318.0	110.72	46.48	0.004	33.12	77.08	18.97
Aki Daizu	184	Shokuyou	573.2	109.62	61.50	0.006	51.05	68.95	16.86
185 Tamawata 489.6 89.90 55.10 0.006 55.30 72.29 15.89 186 Tanbakuro 774.4 144.38 72.55 0.035 69.89 73.83 36.19 187 Tanokuromame 490.1 104.81 54.70 0.006 54.03 77.64 18.53 (Edamane) 188 Tochigi Kuro 646.3 180.56 85.97 0.086 56.99 67.32 43.85 Sengoku 189 Tosuta Daizu 619.8 207.14 63.70 0.013 45.97 75.87 18.78 190 Tounou Keitou 598.8 103.31 69.88 0.015 47.91 54.25 12.33 191 Toyoshirome 651.5 107.22 56.48 0.002 32.89 60.96 12.78 Shirohana 193 Urayama Wase 663.9 117.88 74.48 0.005 70.64 69.37 17.60 194 Uzara Mame 437.1 87.86 64.35 0.016 55.56 73.33 21.70 195 Wase Bon		Aki Daizu							
186 Tanbakuro 77.4.4 144.38 72.55 0.035 69.89 73.83 36.19 187 Tanokuromame 490.1 104.81 54.70 0.006 54.03 77.64 18.53 188 Tochigi Kuro 646.3 180.56 85.97 0.086 56.99 67.32 43.85 Sengoku 50000 501.31 69.88 0.013 45.97 75.87 18.78 190 Tounou Keitou 598.8 103.31 69.88 0.015 47.91 54.25 12.33 191 Toyoshirome 651.5 107.22 56.48 0.007 50.84 79.61 17.84 192 Tsurnoko 520.3 101.47 57.06 0.002 32.89 60.93 12.78 193 Urayama Wase 663.9 117.88 74.48 0.009 45.89 74.18 23.70 194 Uzura Mame 137.1 87.88 64.35 0.016 55.56 73.33 21.76	185	Tamawata	489.6	89.90	55.10	0.006	55.30	72.29	15.89
187 Tanokuromame (Edamame) 490.1 104.81 54.70 0.006 54.03 77.64 18.53 188 Tochigi Kuro 646.3 180.56 85.97 0.086 56.99 67.32 43.85 189 Tostuta Daizu 619.8 207.14 63.70 0.013 45.97 75.87 18.78 190 Toyoshirome 651.5 107.22 55.48 0.007 50.84 74.15 17.34 191 Toyoshirome 651.5 107.22 55.48 0.007 50.84 74.18 23.70 193 Urayama Wase 663.9 117.88 74.48 0.009 45.89 74.18 23.70 194 Uzura Mame 437.1 87.86 64.35 0.016 55.56 73.33 21.70 195 Wase Bon 209.6 89.44 48.90 0.007 56.30 74.60 22.87 197 Wase Mame 182.5 108.47 46.68 0.012 36.02 58.04 14.83 198 Yagi 576.0 115.70 71.22 <td>186</td> <td>Tanbakuro</td> <td>774.4</td> <td>144.38</td> <td>72.55</td> <td>0.035</td> <td>69.89</td> <td>73.83</td> <td>36.19</td>	186	Tanbakuro	774.4	144.38	72.55	0.035	69.89	73.83	36.19
(Edamame) (Edamame) 188 Tochigi Kuroo 646.3 180.56 85.97 0.086 56.99 67.32 43.85 Sengoku 189 Totsuta Daizu 619.8 207.14 63.70 0.013 45.97 75.87 18.78 190 Tounou Keitou 598.8 103.31 69.88 0.015 47.91 54.25 12.33 191 Toyoshirome 651.5 107.22 56.48 0.007 50.84 79.61 17.84 192 Tsurunoko 520.3 101.47 57.06 0.002 32.89 60.96 12.78 Shirohan . <td< td=""><td>187</td><td>Tanokuromame</td><td>490.1</td><td>104.81</td><td>54.70</td><td>0.006</td><td>54.03</td><td>77.64</td><td>18.53</td></td<>	187	Tanokuromame	490.1	104.81	54.70	0.006	54.03	77.64	18.53
188 Tochigi Kuro 646.3 180.56 85.97 0.086 56.99 67.32 43.85 189 Totsuta Daizu 619.8 207.14 63.70 0.013 45.97 75.87 18.78 190 Tounou Keitou 598.8 103.31 69.88 0.015 47.91 54.25 12.33 191 Toyoshirome 651.5 107.22 56.48 0.007 50.84 79.61 17.84 192 Trayama Wase 663.9 117.88 74.48 0.009 45.89 74.18 23.70 194 Uzara Mame 437.1 87.88 64.35 0.016 55.56 73.33 21.70 195 Wase Bon 209.6 89.44 48.90 0.005 70.64 69.37 17.60 196 Wase Mame 182.5 108.47 46.68 0.012 36.02 58.04 14.83 198 Yagi 576.0 115.70 71.22 0.009 35.71 75.50		(Edamame)							
Sengoku Sengoku 189 Totsuta Daiza 619.8 207.14 63.70 0.013 45.97 75.87 18.78 190 Tounou Keitou 598.8 103.31 69.88 0.015 47.91 54.25 12.33 191 Toyoshirome 651.5 107.22 56.48 0.007 50.84 79.61 17.84 192 Tsurunoko 520.3 101.47 57.06 0.002 32.89 60.96 12.78 Shirohana	188	Tochigi Kuro	646.3	180.56	85.97	0.086	56.99	67.32	43.85
189 Totsuta Daizu 619.8 207.14 63.70 0.013 45.97 75.87 18.78 190 Tounou Keitou 598.8 103.31 69.88 0.015 47.91 54.25 12.33 191 Toyoshirome 651.5 107.22 56.48 0.007 50.84 79.61 17.84 192 Tsurunoko 520.3 101.47 57.06 0.002 32.89 60.96 12.78 Shirohana		Sengoku							
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191 Toyoshirome 651.5 107.22 56.48 0.007 50.84 79.61 17.84 192 Tsurunoko 520.3 101.47 57.06 0.002 32.89 60.96 12.78 Shirohana	190	Tounou Keitou	598.8	103.31	69.88	0.015	47.91	54.25	12.33
192 Tsurunoko 520.3 101.47 57.06 0.002 32.89 60.96 12.78 193 Urayama Wase 663.9 117.88 74.48 0.009 45.89 74.18 23.70 194 Uzura Mame 437.1 87.88 64.35 0.016 55.56 73.33 21.70 195 Wase Bon 209.6 89.44 48.90 0.005 70.64 69.37 17.60 196 Wase Keburi 379.5 85.66 65.48 0.007 56.30 74.60 22.87 197 Wase Mame 182.5 108.47 46.68 0.012 36.02 58.04 14.83 198 Yagi 576.0 115.70 71.22 0.009 35.71 75.50 23.16 199 Yagimame 709.7 105.95 77.53 0.005 58.38 72.38 22.39 200 Yamaguchi 491.7 111.14 61.48 0.012 21.79 77.08 23.42 Dairyuu	191	Toyoshirome	651.5	107.22	56.48	0.007	50.84	79.61	17.84
Shirohana 193 Urayama Wase 663.9 117.88 74.48 0.009 45.89 74.18 23.70 194 Uzura Mame 437.1 87.88 64.35 0.016 55.56 73.33 21.70 195 Wase Bon 209.6 89.44 48.90 0.005 70.64 69.37 17.60 196 Wase Keburi 379.5 85.66 65.48 0.007 56.30 74.60 22.87 197 Wase Mame 182.5 108.47 46.68 0.012 36.02 58.04 14.83 198 Yagi 576.0 115.70 71.22 0.009 35.71 75.50 23.16 199 Yagimame 709.7 105.95 77.53 0.005 58.38 72.38 22.39 200 Yamaguchi 491.7 111.14 62.17 0.005 46.84 66.86 11.12 Aki Daizu 201 Yogere Mame 454.6 104.10 56.08 0.	192	Tsurunoko	520.3	101.47	57.06	0.002	32.89	60.96	12.78
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		Shirohana							
194 Uzura Mame 437.1 87.88 64.35 0.016 55.56 73.33 21.70 195 Wase Bon 209.6 89.44 48.90 0.005 70.64 69.37 17.60 196 Wase Keburi 379.5 85.66 65.48 0.007 56.30 74.60 22.87 197 Wase Mame 182.5 108.47 46.68 0.012 36.02 58.04 14.83 198 Yagi 576.0 115.70 71.22 0.009 35.71 75.50 23.16 199 Yagimame 709.7 105.95 77.53 0.005 58.38 72.38 22.39 200 Yamaguchi 491.7 111.14 62.17 0.005 46.84 66.86 11.12 Aki Daizu	193	Urayama Wase	663.9	117.88	74.48	0.009	45.89	74.18	23.70
195 Wase Bon 209.6 89.44 48.90 0.005 70.64 69.37 17.60 196 Wase Keburi 379.5 85.66 65.48 0.007 56.30 74.60 22.87 197 Wase Mame 182.5 108.47 46.68 0.012 36.02 58.04 14.83 198 Yagi 576.0 115.70 71.22 0.009 35.71 75.50 23.16 199 Yagimame 709.7 105.95 77.53 0.005 58.38 72.38 22.39 200 Yamaguchi 491.7 111.14 62.17 0.005 46.84 66.86 111.2 Aki Daizu	194	Uzura Mame	437.1	87.88	64.35	0.016	55.56	73.33	21.70
196 Wase Keburi 379.5 85.66 65.48 0.007 56.30 74.60 22.87 197 Wase Mame 182.5 108.47 46.68 0.012 36.02 58.04 14.83 198 Yagi 576.0 115.70 71.22 0.009 35.71 75.50 23.16 199 Yagimame 709.7 105.95 77.53 0.005 58.38 72.38 22.39 200 Yamaguchi 491.7 111.14 62.17 0.005 46.84 66.86 11.12 Aki Daizu	195	Wase Bon	209.6	89.44	48.90	0.005	70.64	69.37	17.60
197 Wase Mame 182.5 108.47 46.68 0.012 36.02 58.04 14.83 198 Yagi 576.0 115.70 71.22 0.009 35.71 75.50 23.16 199 Yagimame 709.7 105.95 77.53 0.005 58.38 72.38 22.39 200 Yamaguchi 491.7 111.14 62.17 0.005 46.84 66.86 11.12 Aki Daizu	196	Wase Keburi	379.5	85.66	65.48	0.007	56.30	74.60	22.87
198 Yagi 576.0 115.70 71.22 0.009 35.71 75.50 23.16 199 Yagimame 709.7 105.95 77.53 0.005 58.38 72.38 22.39 200 Yamaguchi 491.7 111.14 62.17 0.005 46.84 66.86 11.12 Aki Daizu	197	Wase Mame	182.5	108.47	46.68	0.012	36.02	58.04	14.83
199 Yagimame 709.7 105.95 77.53 0.005 58.38 72.38 22.39 200 Yamaguchi 491.7 111.14 62.17 0.005 46.84 66.86 11.12 Aki Daizu	198	Yagi	576.0	115.70	71.22	0.009	35.71	75.50	23.16
200 Yamaguchi Aki Daizu 491.7 111.14 62.17 0.005 46.84 66.86 11.12 201 Yogore Mame 454.6 104.10 56.08 0.013 57.36 59.15 16.14 202 Yoshioka 429.7 111.01 61.48 0.012 21.79 77.08 23.42 Dairyuu 0 0 62.88 112.41 67.90 0.006 51.81 72.86 23.92 204 Yukikorogashi 450.3 95.31 60.84 0.008 57.33 71.81 16.98 (Kashima) 0 0 56.22 0.008 68.55 74.01 20.16 206 Yukiwari Mame 451.2 108.70 56.22 0.008 68.55 74.01 20.16 207 Zenkou Mame 640.6 127.35 68.35 0.009 45.27 60.13 16.21 208 Zunda Mame 868.5 117.80 68.64 0.006 61.88 74.01 19.40 Foreign cultivars 1 Bay 579.8	199	Yagimame	709.7	105.95	77.53	0.005	58.38	72.38	22.39
Aki Daizu 201 Yogore Mame 454.6 104.10 56.08 0.013 57.36 59.15 16.14 202 Yoshioka 429.7 111.01 61.48 0.012 21.79 77.08 23.42 Dairyuu 0 629.8 112.41 67.90 0.006 51.81 72.86 23.92 204 Yukikorogashi 450.3 95.31 60.84 0.008 57.33 71.81 16.98 (Kashima) 205 Yukinoshita 431.6 111.68 63.53 0.020 59.48 77.78 19.82 206 Yukiwari Mame 451.2 108.70 56.22 0.008 68.55 74.01 20.16 207 Zenkou Mame 640.6 127.35 68.35 0.009 45.27 60.13 16.21 208 Zunda Mame 868.5 117.80 68.64 0.006 61.88 74.01 19.40 579.8 87.59	200	Yamaguchi	491.7	111.14	62.17	0.005	46.84	66.86	11.12
201 Yogore Mame 454.6 104.10 56.08 0.013 57.36 59.15 16.14 202 Yoshioka 429.7 111.01 61.48 0.012 21.79 77.08 23.42 Dairyuu 629.8 112.41 67.90 0.006 51.81 72.86 23.92 204 Yukikorogashi 450.3 95.31 60.84 0.008 57.33 71.81 16.98 (Kashima) .		Aki Daizu							
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Dairyuu 203 Yougetsu 629.8 112.41 67.90 0.006 51.81 72.86 23.92 204 Yukikorogashi 450.3 95.31 60.84 0.008 57.33 71.81 16.98 205 Yukinoshita 431.6 111.68 63.53 0.020 59.48 77.78 19.82 206 Yukiwari Mame 451.2 108.70 56.22 0.008 68.55 74.01 20.16 207 Zenkou Mame 640.6 127.35 68.35 0.009 45.27 60.13 16.21 208 Zunda Mame 868.5 117.80 68.64 0.006 61.88 74.01 19.40 Foreign cultivars 1 Bay 579.8 87.59 42.37 0.004 59.45 56.99 12.25 2 Clark 775.8 77.35 63.33 0.009 42.40 79.87 22.72 3 Jack 505.3 103.72 <t< td=""><td>202</td><td>Yoshioka</td><td>429.7</td><td>111.01</td><td>61.48</td><td>0.012</td><td>21.79</td><td>77.08</td><td>23.42</td></t<>	202	Yoshioka	429.7	111.01	61.48	0.012	21.79	77.08	23.42
203 Yougetsu 629.8 112.41 67.90 0.006 51.81 72.86 23.92 204 Yukikorogashi 450.3 95.31 60.84 0.008 57.33 71.81 16.98 205 Yukinoshita 431.6 111.68 63.53 0.020 59.48 77.78 19.82 206 Yukiwari Mame 451.2 108.70 56.22 0.008 68.55 74.01 20.16 207 Zenkou Mame 640.6 127.35 68.35 0.009 45.27 60.13 16.21 208 Zunda Mame 868.5 117.80 68.64 0.006 61.88 74.01 19.40 Foreign cultivars 1 Bay 579.8 87.59 42.37 0.004 59.45 56.99 12.25 2 Clark 775.8 77.35 63.33 0.009 42.40 79.87 22.72 3 Jack 505.3 103.72 56.75 0.007 50.54 80.13 23.26 4 Peking 815.0 256.		Dairyuu							
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(Kashima) 205 Yukinoshita 431.6 111.68 63.53 0.020 59.48 77.78 19.82 206 Yukiwari Mame 451.2 108.70 56.22 0.008 68.55 74.01 20.16 207 Zenkou Mame 640.6 127.35 68.35 0.009 45.27 60.13 16.21 208 Zunda Mame 868.5 117.80 68.64 0.006 61.88 74.01 19.40 Foreign cultivars 1 Bay 579.8 87.59 42.37 0.004 59.45 56.99 12.25 2 Clark 775.8 77.35 63.33 0.009 42.40 79.87 22.72 3 Jack 505.3 103.72 56.75 0.007 50.54 80.13 23.26 4 Peking 815.0 256.24 101.55 0.121 72.50 60.33 78.44	204	Yukikorogashi	450.3	95.31	60.84	0.008	57.33	71.81	16.98
205 Yukinoshita 431.6 111.68 63.53 0.020 59.48 77.78 19.82 206 Yukiwari Mame 451.2 108.70 56.22 0.008 68.55 74.01 20.16 207 Zenkou Mame 640.6 127.35 68.35 0.009 45.27 60.13 16.21 208 Zunda Mame 868.5 117.80 68.64 0.006 61.88 74.01 19.40 Foreign cultivars 1 Bay 579.8 87.59 42.37 0.004 59.45 56.99 12.25 2 Clark 775.8 77.35 63.33 0.009 42.40 79.87 22.72 3 Jack 505.3 103.72 56.75 0.007 50.54 80.13 23.26 4 Peking 815.0 256.24 101.55 0.121 72.50 60.33 78.44		(Kashima)							
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207 Zenkou Mame 640.6 127.35 68.35 0.009 45.27 60.13 16.21 208 Zunda Mame 868.5 117.80 68.64 0.006 61.88 74.01 19.40 Foreign cultivars 1 Bay 579.8 87.59 42.37 0.004 59.45 56.99 12.25 2 Clark 775.8 77.35 63.33 0.009 42.40 79.87 22.72 3 Jack 505.3 103.72 56.75 0.007 50.54 80.13 23.26 4 Peking 815.0 256.24 101.55 0.121 72.50 60.33 78.44	206	Yukiwari Mame	451.2	108.70	56.22	0.008	68.55	74.01	20.16
208 Zunda Mame 868.5 117.80 68.64 0.006 61.88 74.01 19.40 Foreign cultivars 1 Bay 579.8 87.59 42.37 0.004 59.45 56.99 12.25 2 Clark 775.8 77.35 63.33 0.009 42.40 79.87 22.72 3 Jack 505.3 103.72 56.75 0.007 50.54 80.13 23.26 4 Peking 815.0 256.24 101.55 0.121 72.50 60.33 78.44	207	Zenkou Mame	640.6	127.35	68.35	0.009	45.27	60.13	16.21
Foreign cultivars1Bay579.887.5942.370.00459.4556.9912.252Clark775.877.3563.330.00942.4079.8722.723Jack505.3103.7256.750.00750.5480.1323.264Peking815.0256.24101.550.12172.5060.3378.44	208	Zunda Mame	868.5	117.80	68.64	0.006	61.88	74.01	19.40
Foreign cultivars 1 Bay 579.8 87.59 42.37 0.004 59.45 56.99 12.25 2 Clark 775.8 77.35 63.33 0.009 42.40 79.87 22.72 3 Jack 505.3 103.72 56.75 0.007 50.54 80.13 23.26 4 Peking 815.0 256.24 101.55 0.121 72.50 60.33 78.44									
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3 Jack 505.3 103.72 56.75 0.007 50.54 80.13 23.26 4 Peking 815.0 256.24 101.55 0.121 72.50 60.33 78.44	2	Clark	775.8	77.35	63.33	0.009	42.40	79.87	22.72
4 Peking 815.0 256.24 101.55 0.121 72.50 60.33 78.44	3	Jack	505.3	103.72	56.75	0.007	50.54	80.13	23.26
	4	Peking	815.0	256.24	101.55	0.121	72.50	60.33	78.44

Total isoflavones are shown in mg/100g fresh weight; total phenolics are shown in mg GAE/100g f.w.; total flavonoids are shown in mg QE/100g f.w.; Anthocyanin contents are expressed as OD_{510} of the extracts; AA: antioxidant activity; SCA: scavenging activity; FRP: ferric reducing power.

2. Total phenolic, total flavonoid and anthocyanin contents

Phenolic compounds are very important plant metabolites because of their physiological functions against oxidative damage. Flavonoids are phenolic compounds and anthocyanins are flavonoids, which are very effective antioxidants. Total phenolic contents per 100g soybean seeds varied ranging from 62.43 mg GAE (Gokuwasekamishunbetsu) to 256.24 mg GAE (Peking). Total flavonoids in seeds were also lowest for Gokuwasekamishunbetsu (36.19 mg QE/100g) and highest for Peking (101.55 mg QE/100g). Anthocyanin contents in seeds were lowest for Tsurunoko Shirohana, Akasaya, Hyuuga and Kuma Daizu 2 and highest for Peking. The cultivars with black seed coat, especially Peking, possessed high amount of these antioxidant compounds.



Fig. 2 Average concentrations of 12 isoflavones calculated from the contents of 217 cultivars used in this study; numbers above bars indicate relative percent to total isoflavones and the concentration (mg/100g) of each isoflavone; MDai: malonyldaidzin, MGly: malonylglycitin, MGen: malonylgenistin, ADai: acetyldaidzin, AGly: acetylglycitin, AGen: acetylgenistin.

3. Antioxidant activity in β-carotene linoleate model system

This assay was performed to determine the ability of soybean seed extracts to inhibit β carotene oxidation by neutralizing the linoleate-free radical occurred in β -carotene linoleate model system. In the reaction containing the extracts, the degradation of β -carotene was slower and the β -carotene content remaining in the system was higher than that of control reaction after 3 hr from starting the assay (Fig. 3). Soybean extracts of all cultivars analyzed in this study showed antioxidant activity. The antioxidant activity (AA) values ranged from 9.34% in Houjaku Kuwazu to 85.02% in Hiroshima Kuro Daizu, but most cultivars exhibited moderate values between 40 and 60%. The ability to inhibit β -carotene oxidation did not correlate with total isoflavone (r = 0.033), total phenolic (r = 0.116) and total flavonoid (r = 0.133) contents. However, it showed correlation with anthocyanin contents (r = 0.217; P < 0.05).

4. DPPH radical scavenging activity

The proton radical scavenging action is known to be one of the various mechanisms for measuring antioxidant activity. DPPH radical is a stable proton free radical whose purple color fades rapidly when it encounters proton radical scavengers⁶. This assay determines the hydrogen-donor capability of antioxidants. The scavenging activities in cultivars tested ranged from 36.97% (Shichigou Cha Mame) to 81.61% (Hazenomi Daizu). Most cultivars showed high activity between 70 and 80%. DPPH radical scavenging activity did not correlate with total isoflavone (r = 0.126), total phenolic (r = 0.126), total flavonoid (r = 0.140) and relative anthocyanin (r = 0.047) contents.



Fig. 3 Changes in β-carotene content during the incubation at 50 °C for 180 min in the cultivars with highest, medium and lowest AA (Hiroshima Kuro Daizu, Hazenomi Daizu and Houjaku Kuwazu, respectively).

5. Ferric reducing power

This assay measures the potential of antioxidants present in soybean seeds to act as reducing agent which can be monitored spectrophotometrically at 700 nm. Higher intensity of the absorbance indicates higher reducing power. Ferric reducing powers among cultivars tested ranged from 9.26% (Shichigou Cha Mame) to 78.44% (Peking). The reducing power of the soybean extracts did not correlate with total isoflavones (r = 0.170). While it positively and significantly correlated with total phenolic (r = 0.624; P < 0.001), total flavonoid (r = 0.551; P < 0.001) and especially with total anthocyanin (r = 0.822; P < 0.001) contents. It is concluded that ferric reducing powers of soybeans tested in this study were contributed by the presence of anthocyanins.

In conclusion, there are differences in the contents of each antioxidant compounds among Japanese soybean cultivars. We consider that among 217 cultivars used in this study, the cultivars with black seed coat are recommended to serve as dietary consumption. Especially, Peking can be considered as the superior phytonutrient supplier since this cultivar has high isoflavone, phenolic, flavonoid and anthocyanin contents. Moreover, it also showed high antioxidant activities evaluated in all 3 assays.

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日本産ダイズにおけるイソフラボン含量および 抗酸化活性の品種間差異について

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摘 要

我が国原産のダイズ品種を中心として,佐賀大学が保有する217品種を供試して,その重要 な機能成分であるイソフラボン含量の品種間差異を検討した.その含量は,143g1,171g/100 gと低含有から高含有のものまで,広範囲に分布した.すべての品種において,主要なイソフ ラボンはマロニル配糖体であった.さらに3種の測定法による抗酸化活性の測定をおこない, イソフラボン含量に加え,フェノール,フラボノイド,アントシアニン含量を定量し,これら の相間関係を検討した.抗酸化活性との関連はイソフラボンでは低く,アントシアニン含量と の関連が高く,なかでも黒ダイズ品種の抗酸化活性は顕著であった.なかでも「ペキン」は抗 酸化活性が高く,しかもイソフラボンも高含有しており,機能性ダイズ新品種開発の素材とし て注目された.