A Sino-Japan bilateral comparison study on evaluation and determination of rapeseed quality

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Abstract

A bilateral comparison study on evaluation and determination of rapeseed seed quality was carried out from 1999 to 2004 between China and Japan. The results showed that erucic acid, glucosinolates, oil, protein and chlorophyll content measured by Quality and Safety Inspection and Test Center for Oilseeds Products (QSITCOP), Agricultural Ministry of China, according to national standards of China and ISO standards were very close to the ones by Japan Oil stuff Inspectors' Corporation (NYKK) according to national standards of Japan and AOCS standards. The absolute differences between the results obtained by QSITCOP and NYKK were less than 0.41% for erucic acid, 5.82μmol/g for glucosinolates, 2.17% for oil content, 0.47% for protein content and 0.27% for chlorophyll content, respectively. Good reproducibility for erucic acid, glucosinolates, oil, protein and chlorophyll content determination with identical test material indicated that the analytical techniques and results of erucic acid, glucosinolates, oil, protein and chlorophyll content in rapeseed seeds measured by QSITCOP were internationally accepted. A platform was established for bilateral and multilateral authentication on analytical techniques of rapeseed seed quality. It is important not only to the improvement of rapeseed quality and analytical techniques, but also beneficial to international rapeseed trade.

Key words: Rapeseed; Quality; Bilateral Determination; Evaluation

Regards to the total output and production area of rapeseed, China where the consumption of rapeseed oil accounts for 35% of the total vegetable oil has been on the leading position in the world. Facing to the international competitive market and the impact from the entrance to WTO, establishment of the quality test methods and standards is very important not only to the improvement of rapeseed quality, but also to the international rapeseed export and import trade. Japanese people are very favor of rapeseed oil, and Japan where there is very little rapeseed production is a rapeseed importing country with very strict detecting technique and agro-product standard system. To improve analytical technique of rapeseed seed quality and establish the quality standards, a bilateral comparison study on evaluation and determination of erucic acid, glucosinolates, oil, protein and chlorophyll content in rapeseed seed was carried out from 1998 to 2004 between QSITCOP and NYKK supported by the Japan International Cooperation Agency (JICA).

1. Materials and method

1.1 Materials

Rapeseed produced in Hubei Province of China were selected as materials for comparison analysis.

In 1999-2000, erucic acid and glucosinolates contents in double low rapeseed varieties of zhongshuang 4, huashuang 2 and Qingyou14 collected by JICA program office, were analyzed by Quality Inspection and Test Center for Oilseeds Products, Agricultural Ministry of China with national standards of China and Japan Oil stuff Inspectors' Corporation with standards of JOCS.

In 2001, 2003 and 2004, samples from Shayang, Wuxue, angyang, Xiangyan and Qianjang where were the JICA observation bases in Hubei, China were used. Each sample was divided into 3 parts, and delivered to QSITCOP, NYKK and the JICA Project Office in Wuhan. Erucic acid, glucosinolates and oil content in 2001, glucosinolates, oil and protein content in 2003, erucic acid, glucosinolates, oil, protein and chlorophyll content in 2004 were analyzed and compared.

1.2 Method and apparatus

1.2.1 Erucic acid content analysis in rapeseed seed :national standards of China GB/T 17377－1998 and HP 5890IIGC were used by the QSITCOP in China. Basic method of 2.4.2-1996 edited by Japan oil chemists society and Hitachi 263－70 GC were adopted by NYKK in Japan.

1.2.2 Glucosinolates content analysis in rapeseed seed:ISO 9167-1 1992(E) and waters 5510/717/996 HPLC were used by the QSITCOP. AOCS Official Method AK1-92 and HP 1100 HPLC were applied by NYKK.

1.2.3 Oil content analysis in rapeseed seed:national standards of China GB/T 14488.1－1993 was used by the QSITCOP. Basic method for oil and fat 1.5-1996 was used by NYKK.

1.2.4 Protein content analysis in rapeseed seed:national standards of China GB/T 14489.2－1993 was used by QSITCOP. Basic method for oil and fat 1.7.2-1996 from JOCS was adopted by NYKK.

1.2.5 Chlorophyll content analysis in rapeseed seed:ISO10519:1997(E) was used by QSITCOP. Basic method for oil and fat 1.14-1996 from JOCS was applied by NYKK.

2. Results

2.1 Erucic acid content

The erucic acid content analysis was carried out in both laboratories with different instruments and methods. The results showed that absolute differences were from 0.00% to 0.41%,which was lower than the limit value of 3% within the acceptable standard errors (see table 1). It was indicated that erucic acid content measured by the QSITCOP in China according to national standard of China were very close to the ones by the NYKK in Japan according to national standard of Japan.

Table1 Erucic acid in rapeseed seed measured by QSITCOP and NYKK in China and Japan (%)

Year	Lab	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
	QSITCOP	6.42	0.85	0.06		
1999	NYKK	6.50	0.60	0.10		
	Absolute differences	0.08	0.25	0.04		
	QSITCOP	2.02	2.36	0.28	0.30	
2001	NYKK	1.81	2.46	0.17	0.17	
	Absolute differences	0.21	0.10	0.11	0.13	
	QSITCOP	0.98	13.39	0.12	0.52	3.40
2004	NYKK	0.80	13.80	0.10	0.40	3.40
	Absolute differences	0.18	0.41	0.02	0.12	0.00

*In 1999, Sample was Zhongshuang No.4,Sample 2 was Huashuang No.2, Sample 3 was Qingyou No.14. In 2001 and 2004, Sample 1 from Shayang, Sample 2 from Wuxue, Sample 3 from Dangyang, Sample 4 from Xiangyan, Sample 5 from Qianjang

2.2 Glucosinolates content

The results of glucosinolates content in both laboratory with different instruments and methods based on 8.5% of water were shown in table 2. The absolute difference was 8.85μmol/g between the QSITCOP and NYKK, which implied there was a distinct difference because of different instruments, technicians and methods.

Since 2001, a Sino-Japan bilateral comparison study on evaluation and determination of rapeseed quality was supported by the JICA. The operation condition and instrument parameter were taken into account. The results showed that absolute differences were from 0.29μmol/g seed to 5.82μmol/g, which was lower than the limit of 8μmol/g, which was the acceptable standard errors (as shown in table 2). It was concluded that results of glucosinolates content measured by the QSITCOP in China according to ISO standard were very close to the ones by the NYKK in Japan according to AOCS standard.

Table 2 Glucosinolates content in rapeseed seed measured by QSITCOP in China and NYKK in Japan (μmol/g)

Year	Lab	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
	QSITCOP	31.15	22.27	24.67		
1998	NYKK	40.00	27.00	23.00		
	Absolute differences	8.85	4.73	1.67		
	QSITCOP	24.05	20.09	11.59	12.11	
2001	NYKK	22.00	19.80	9.57	10.85	
	Absolute differences	2.05	0.29	1.84	1.26	
	QSITCOP	18.38	68.98	8.24		
2003	NYKK	19.50	74.80	6.90		
	Absolute differences	1.12	5.82	1.34		
	QSITCOP	24.93	42.43	15.05	16.25	28.31
2004	NYKK	21.70	29.4	18.1	19.2	23.8
	Absolute differences	3.16	3.03	3.05	3.05	4.51

*In 1998, Sample 1 was Zhongshuang No.4, Sample 2 was Huashuang No.2, Sample 3 was Qingyou No.14.In 2001,2003 and 2004,Sample 1 from Shayang, Sample 2 from Wuxue, Sample 3 from Dangyang, Sample 4 from Xiangyan,Sample 5 from Qianjang

Table 3 Oil content in rapeseed measured by QSITCOP and NYKK in China and Japan (%)

Year	Lab	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
	QSITCOP	40.62	36.26	34.24	32.87	
2001	NYKK	41.99	37.86	35.17	35.04	
	Absolute differences	1.37	1.60	0.93	2.17	
	QSITCOP	34.05	35.58	33.52		
2003	NYKK	35.97	37.46	35.13		
	Absolute differences	1.92	1.88	1.61		
	QSITCOP	33.82	37.18	35.94	33.70	36.32
2004	NYKK	35.73	39.05	37.52	35.63	38.05
	Absolute differences	1.91	1.87	1.58	1.93	1.73

*In 2001,2003 and 2004,Sample 1 from Shayang, Sample 2 from Wuxue, Sample 3 from Dangyang, Sample 4 from Xiangyan,Sample 5 from Qianjang

2.3 Oil content

Oil content were measured by QSITCOP in China and NYKK in Japan in 2001,2003 and 2004 with the same rapeseed seed samples. The oil content in rapeseed seed was based on 8.5% of water (see table 3). The results showed that absolute differences were from 0.93% to 2.17%, which was higher than the maximal limit of 0.8%. It was found the reasons for the oil content differences between QSITCOP in China and NYKK in Japan, were from different grinding methods, extracting time and methods.

2.4 Protein content

In 2003 and 2004 the protein content in rapeseed seed was measured in both laboratories based on 8.5% of water (see table 4). The results showed that absolute differences was from 0.02％ to 0.47％, which was lower than the maximal limit value 1% of the acceptable standard errors of the methods.

Table 4 Protein content in rapeseed seed measured by QSITCOP and NYKK in China and Japan (%)

Year	Lab	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
2003	QSITCOP	22.47	23.04	25.43		
	NYKK	22.00	22.81	25.00		
	Absolute differences	0.47	0.23	0.43		
2004	QSITCOP	23.54	21.56	23.35	22.83	24.34
	NYKK	24.00	21.81	23.81	22.81	24.81
	Absolute differences	0.46	0.25	0.46	0.02	0.37

* Sample 1 from Shayang, Sample 2 from Wuxue, Sample 3 from Dangyang, Sample 4 from Xiangyan,Sample 5 from Qianjang

2.5 Chlorophyll content

Chlorophyll contents form the same rapeseed samples were measured by QSITCOP and NYKK in 2004. The chlorophyll content in rapeseed was calculated on the base of water 8.5% (see table 5). The results showed that absolute differences was from 0.05％ to 0.276％, which was within the acceptable standard errors of the methods.

Table 5 Chlorophyll content in rapeseed seed measured by QSITCOP and NYKK in China and Japan in 2004 (%)

Lab	Shayang	Wuxue	Dangyang	Xiangyan	Qianjang
QSITCOP	3.05	0.86	4.10	3.14	2.87
NYKK	3.10	0.80	3.90	3.40	2.60
Absolute differences	0.05	0.06	0.20	0.26	0.27

3 Discussion

More than two million tons of rapeseed seed were imported from Canada and China by Japan every year. There are very strict detecting technique standard and agro-product quality standard for the quality and safety control of rapeseed. Sino-Japan bilateral comparison study on evaluation and determination of rapeseed quality showed that the results of erucic acid, glucosinolates, oil, protein and chlorophyll content measured by the QSITCOP according to national standards of China and ISO standards were very close to the ones by Japan the NYKK according to national standards of Japan and AOCS standards although the different methods, condition and apparatus operated with different technicians. Good reproducibility of the results for erucic acid, glucosinolates, protein and chlorophyll content with identical test material in both laboratories indicated that the analytical techniques and results of erucic acid, glucosinolates, protein and chlorophyll content in rapeseed measured by the QSITCOP were internationally accepted. A platform was established for bilateral and multilateral authentication on analytical techniques of rapeseed seed quality.

Oil content measured by QSITCOP was lower than that from NYKK. The possible reasons for the differences may be the less grinding times without application of quartz during the grinding. It was put forward that the standard for oil content in rapeseed seed should be revised.