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Differences in Nutrient Quality among Rape Varieties for Oil Seed and Forage

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ABSTRACT : In order to examine the possibility that oil seed rape could be used as a forage fodder crop and to select the most suitable variety of forage rape at the southern area of Korea, two varieties of oil seed rape currently grown for oil production and six introduced varieties of forage rape with relatively high yield and high nutritional value were grown at the same condition and their nutritional value were observed. Generally, rape was considered as a useful forage fodder crop with high content of crude protein and low contents of NDF, ADF, hemicellulose, cellulose and lignin. Differences in mean values of the above characters between two groups of rape were not statistically significant. Velox showed significantly higher content of crude protein and significantly lower contents of NDF, ADF, hemicellulose, cellulose and lignin compared with other varieties of forage rape. Rape was relatively high in IVDMD compared with other forage fodder crops, and forage rape was more or less higher in IVDMD and DDMM than oil seed rape. Velox was the highest in IVDMD and DDMM among the varieties of forage rape in this experiment.

Keywords: Crude protein, Content of fiber, IVDMD, DDMW

Based on the usage, rape can be divided into two groups, oil seed rape and forage rape. Not only forage rape but oil seed rape in known to be relatively higher in nutritional value of shoot than Gramineae forage crop or other forage fodder crops (Gupta *et al.*, 1974; Macleod,1974; Kay *et al.*,1977; Sheldrick and Lavender, 1981; Yun, I. I., and H. J. Lee, 1981; Groppel *et al.*,1982; Lee, H. J. *et al.*, 1983; Lee, H. J. and J. H. Kang, 1984; Jung *et al.*, 1984; Choi, Y, W. and H. J. Lee. 1985).

Consequently, oil seed rape as well as forage rape seems to be used for the production of forage fodder. The purpose of this study is to examine the possibility that oil seed rape can be used as a forage fodder crop and to select the most suitable variety of forage rape at the southern area of Korea. Two varieties of oil seed rape currently grown for oil production and six introduced varieties of forage rape with high nutritional value were grown at the same place and nutritional value were observed and compared.

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MATERIALS AND METHODS

The dried samples were ground in a Wiley mill to pass through 18-mesh screen and stored at 18 and then subject to chemical analysis. Kjeldahl procedure was used to estimate crude protein(CP) (AOAC, 1970). Contents of fiber such as neutral detergent fiber(NDF), acid detergent fiber (ADF), permanganate lignin(PL) and cellulose were determined by the procedure described in Goering and Van Soest(1970). The content of hemicellulose was estimated by the difference between NDF and ADF. The procedure of pepsin-cellulase assay (Goto and Minson, 1977) was used to determine *in vitro* dry matter digestibility(IVDMD) and digestible dry matter yield (DDMY) was calculated by the product of dry matter yield and IVDMD.

RESULTS AND DISCUSSION

Content of crude protein

As shown in table 1, mean content of crude protein for oil seed rape was 16.9 and for forage rape, 18.2 percent. Content of crude protein in forage rape was about 1 percent higher than that of oil seed rape but it was statistically non-significant.

Content of crude protein in some varieties of forage rape such as Brassica 192-4-80, Emerald and English Giant were lower than of Naehan yuchase, 17.37 percent. The results were in agreement with the reports (Groppel *et al.*, 1982; Gupta *et al.*, 1974). Groppel *et al.* (1982) calculated nutrient content for 19 different types of winter grazing and found that rape and winter cereals were highest in crude protein. Gupta *et al.* (1974) reported that content of crude protein ranged from 12 to 23 percent when it was measured for nine brassica

Table 1. The chemical components of oil seed rape and forage rape.

Item / Variety	Chemical components of dry matter weight(%)					
	CP	NDF	ADF	Hemicellulose	Cellulose	Lignin
			Oil seed rape;			
Naehan yuchae	17.37	38.47	34.45	4.02	29.63	3.54
Youngsan yuchae	16.52	39.21	35.18	4.03	30.31	3.76
Mean±SD	16.90±0.60	38.80±0.52	34.80±0.52	4.00±0.00	30.00±0.48	3.70±0.16
			Forage rape;			
Akela	20.01	39.80	35.33	4.47	29.72	3.93
Brassica192-4-80	17.31	40.73	36.50	4.24	30.64	4.08
Canard	17.45	40.51	36.14	4.38	30.56	4.03
Emerald	16.72	41.27	37.25	4.02	31.21	4.12
English Giant	16.84	41.99	37.82	4.17	31.76	4.14
Velox	21.05	37.99	34.48	3.51	27.84	2.45
Mean±SD	18.20±1.83	40.40±1.38	36.30±1.23	4.10±0.34	30.30±1.38	3.80±0.66

Table 2. The *in vitro* dry matter digestibility and digestible dry matter weight of oil seed rape and forage rape.

Item / Variety	IVDMD(%)		DDMW(g/plant)		
	Stem	Leaf	Total	Stem	Leaf
Oil seed rape;					
Naehan yuchae	75.52	81.57	276.6^{d}	147.6^{d}	129.0^{f}
Youngsan yuchae	74.36	80.59	260.6^{d}	145.6^{d}	115.0^{a}
Mean±SD	74.90±0.82	81.10±0.69	268.6±11.31	146.6±1.41	122.0±9.90
Forage rape;					
Akela	77.16	82.37	457.6^{b}	283.3^{b}	174.3^{b}
Brassica192-4-80	77.06	82.45	425.2^{c}	280.7^{b}	144.5^{a}
Canard	79.97	84.71	$448.6b^{bc}$	280.0^{b}	168.6^{bc}
Emerald	77.39	82.52	426.0^{c}	269.9^{c}	156.1^{d}
English Giant	77.59	84.34	445.8^{bc}	282.8^{b}	163.0^{c}
Velox	77.72	84.74	521.3^{a}	337.8^{a}	183.5^{a}
Mean±SD	77.80±1.08	83.50±1.19	454.1±35.36	289.1±24.36	165.0±13.75

Mean seperation within column by Duncan's multiple range test at 5% level.

species. There were statistically significant differences in crude protein among varieties of forage rape and Velox was the highest one in content of crude protein with 21.05 percent.

Content of fiber

Mean contents of NDF, ADF, hemicellulose, cellulose and lignin for oil seed rape were 38.8, 34.8, 4.0, 30.0 and 3.7 percent, respectively, and for forage rape were 40.4, 36.3, 4.1, 30.3 and 3.8 percent, respectively (Table 1). There was no significant difference in these variables between two groups of rape but there were significant differences among varieties of forage rape. Velox was the lowest in content of fiber. The results were fairly in agreement with those of Berendonk (1982a, 1982b, 1983a, 1983b) and Groppel *et al.*(1982).

Berendonk (1982a, 1982b, 1983a, 1983b) reported that the content of crude fiber in rape varied within 2 percent under variations of growing environment and with variety. Groppel *et al.*,(1982) found that rape was the lowest in crude fiber when nutrient content was calculated for 19 different types of winter grazing.

In vitro dry matter digestibility (IVDMD)

Average IVDMD of oil seed rape was 74.9 percent for the stem and 81.1 percent for the leaf and that of forage rape was 77.8 percent for the stem and 83.5 percent for the

leaf(Table 2). IVDMD of forage rape was 2.9 percent higher in the stem and 2.4 percent higher in the leaf compared with oil seed rape and the differences were significant at the 5% level. Velox which was high in crude protein and low in NDF, ADF, hemicellulose, cellulose and lignin showed 77.72 percent of IVDMD far the stem and 84.74 percent for the leaf.

According to the above results, rape, especially forage rape, shows higher IVDMD compared with forage crops and it is consistent with other reports (Harris, 1964; Gupta *et al.*, 1974; Macleod, 1974, Kay, 1975; Sheldrick and Lavender. 1981; Jung *et al.*, 1984, 1986). According to Harris (1964) and Jung *et al.*, (1984, 1986) , IVDMD for forage rape ranged from 78.5 to 83.9 percent, which was comparatively higher even though it varied under different growing conditions and with variety. Kay(1975) reported that forage brassica possessed the potential for high yields of energy and protein and in terms of both energy and protein content these were similar to young grass. IVDMD of brassica fodder ranged from 67 percent to 84 percent (Gupta *et al.*, 1974) and forage rape was the highest in digestibility with 70.8 percent compared with turnip and fodder radish (Sheldrick and Lavender 1981; Macleod, 1974).

Digestible dry matter weight (DDMW)

Mean DDMW of oil seed rape was 146.6 g for a stem, 122.0 g for a leaf and hence 268.6 g for whole plant and that of forage rape was 289.1 g for a stem, 165.0 g for a leaf and gave 454.1 g for the whole plant (Table 2). DDMW of forage rape was much greater than that of oil seed rape and the difference in mean value was significant at the 1% level. Especially with the stem, forage rape was twice as much DDMW as oil seed rape. Analyses of variance among varieties of forage rape were significant and Velox with DDMW of 337.8 g for a stem and 183.5 g for a leaf was superior to the rest of varieties. Lubenets and Yashchenko(1985) found that the most promising grass fodder crop was swede rape when they grew 95 varieties of different fodder crops on the light acidic soils of European Russia. According to the report by Harper and Compton(1980), the principal value of brassica crops was in providing forage with dry matter yield from 4 to 8 MT/ha for autumn grazing *in situ* at a time of year when production from grassland was declining. In addition, they provided an acceptable feed of high nutritive value at relatively low cost. Judging from the reports and the results so far obtained, forage rape provides high digestible dry matter yield with high nutritive value, so that it can be recommended as a catch fodder crop. Furthermore, Velox is considered to be a suitable variety at the southern area of Korea.

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