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Varietal Differences of Nutrient Quality of Rape in Spring Sowing

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ABSTRACT

This study was conducted to investigate 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 in Spring. 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 in spring. Rape was relatively high in IVDMD compared with other forage fodder crops, and forage rape was more or less in IVDMD and DDMW than oil seed rape. Velox was the highest in IVDMD and DDMW among the varieties of forage rape in Spring, in this experiment.

Key words **:** Spring sowing Crude protein, Content of fiber, IVDMD, DDMW.

INTRODUCTION

Forage rape in Korea has been grown as an oil seed crop at only limited areas in the southern region of korea and the Cheju island. According to the reports by kim (1985), forage rape can be sown at mid-September and harvested at early spring, from mid - to late -April, and hence provides green forage of high quality at the time when green forage is in short supply. Since newly developed varieties of forage rape mature early with high dry matter yield and are of erect type so that they are more convenient to utilize than any other winter forage crop, they have high potential as the second crop of maize (Kim *et al.*, 1986). A large number of varieties of forage rape were bred through interspecific or varietal crosses in Europe, U. S. A and New Zealand. Some of them characteristically are not only well adapted to various environmental conditions but resistant to low temperature, mature early and produce high dry matter yield with high nutrient quality(Macleod, 1974 ; Harper and Compton, 1980; Sheldrick and Lavender, 1981 ; Sheldrick *et al.*, 1981 ; Jung *et al.*, 1983 ; Guillard and Allinson, 1984 ; Smith *et al.*, 1985 ; Lubenets ad Yashchenko, 1985 ; Jung *et al.*, 1986).

Many researches have been conducted to examine

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the effects of environmental conditions, cultual methods and harvest dates on yield and nutritional value of forage rape. Many investigators reported that forage rape showed high digestibility and had much higher contents of energy, crude protein and mineral elements.

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 was observed and compared.

MATERIALS AND METHODS

Rape varieties for oil seed and forage were grown at the experimental farm of Sunchon local in Korea. Seeds were sown in main field on Mar. 15 with 50×50cm distance with one plant per hill.

The fertilizer was applied in the field at ratio of N-P_2O_5-K_2O=8-6-6 kg/10a and other cultural practices followed the conventional method of spring cultivation in the southern region of Korea.

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 weight (DDMW) was investigated from the dry matter weight and in vitro dry matter digestibility.

RESULTS AND DISCUSSION

Content of crude protein

As shown in table 1, mean content of crude protein for oil seed rape was 14.82 and for forage rape, 17.14 percent. Content of crude protein in forage rape was about 1 percent higher than that of oil seed rape but it was statistically nonsignificant.

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, 25.21 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 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 36.64, 32.80, 3.90, 28.70 and 3.20 percent, respectively, and for forage rape were 38.80, 35.04, 3.75, 28.27 and 3.72 percent, respectively (Table 1). There was no significant difference in these values 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

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

Item / Variety	Chemical components of dry matter weight(%)					
	Crude protein	Neutral detergent fiber	Acid dethrgent fiber	Hemicellulose	Cellulose	Lignin
Oil seed rape;						
Naehan yuchae	25.21	36.11	32.15	3.96	28.18	3.12
Youngsan yuchae	24.43	37.18	33.35	3.83	29.25	3.35
Mean±SD	24.82	36.64	32.80	3.90	28.70	3.20
	± 0.42	± 0.36	± 0.41	± 0.05	± 0.43	± 0.08
Forage rape;						
Akela	19.14	37.54	34.21	3.33	27.81	3.72
Brassica192-4-80	18.25	39.25	35.15	4.10	28.57	4.01
Canard	15.39	39.11	35.12	3.99	28.45	4.00
Emerald	14.35	40.25	36.11	4.14	29.11	4.08
English Giant	14.55	40.47	36.49	3.98	29.56	4.11
Velox	20.17	36.15	33.18	2.97	26.17	2.37
Mean±SD	17.14	38.80	35.04	3.75	28.27	3.72
	± 1.67	± 1.27	± 1.17	± 0.25	± 1.25	± 0.54

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 73.03 percent for the stem and 78.98 percent for the leaf and that of forage rape was 75.67 percent for the stem and 81.48 percent for the leaf(Table 2). IVDMD of forage rape was 2.64 percent higher in the stem and 2.50 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 75.82 percent of IVDMD far the stem and 82.88 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).

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

Item / Variety	IVDMD(%)		DDMW(g/plant)		
	Stem	Leaf	Total	Stem	Leaf
Oil seed rape;					
Naehan yuchae	73.61	79.40	253.1^{dz}	135.1^{dz}	118.0f^{z}
Youngsan yuchae	72.45	78.50	240.5^{d}	134.5^{d}	106.0^{a}
Mean±SD	73.03	78.98	246.8	134.8	122.0
	±0.75	±0.54	±9.27	±1.37	±8.71
Forage rape;					
Akela	75.25	80.17	420.5b^{z}	265.3^{bz}	152.2b^{z}
Brassica192-4-80	75.13	80.26	384.5^{c}	260.2^{b}	124.3^{a}
Canard	76.87	82.85	405.6b^{bc}	260.1^{b}	145.5^{bc}
Emerald	75.41	80.49	380.9^{c}	249.5^{c}	131.4^{d}
English Giant	75.58	82.25	408.4^{bc}	267.3^{b}	141.1^{c}
Velox	75.82	82.88	483.1^{a}	315.8^{a}	167.3^{a}
Mean±SD	75.67	81.48	413.8	269.7	144.1
	±1.04	±1.07	±29.28	±21.12	±11.48

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

Digestible dry matter weight (DDMW)

Mean DDMW of oil seed rape was 134.8 g for a stem, 112.0 g for a leaf and hence 246.8 g for whole plant and that of forage rape was 269.7 g for a stem, 144.1 g for a leaf and gave 413.8 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 315.8 g for a stem and 167.3 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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