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## Effects of phenological stages on forage quality in nine range species in Alborz rangelands

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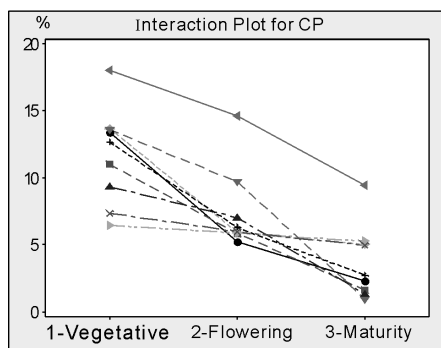
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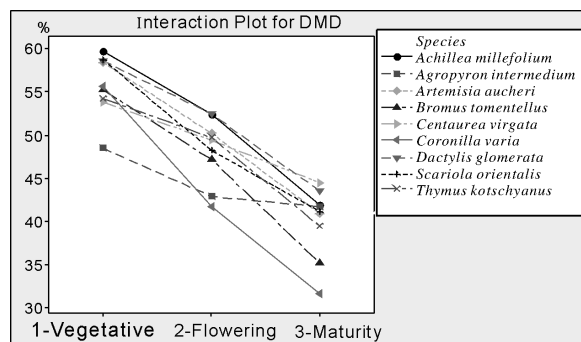
**Introduction** Phenological stages are the most important factor determining forage quality for grazing livestock.

**Material and methods** Nine Range species: *Achillea millefolium*, *Centaurea virgata*, *Coronilla varia*, *Agropyron intermedium*, *Bromus tomentellus*, *Dactylis glomerata*, *Artemisia aucheri*, *Scariola orientalis* and *Thymus kotschyanus* were cut at three phenological stages (vegetative, flowering and seed ripening) in Alborz rangelands, Taleghan, Iran in 2007. For each species 15 plants were cut, dried and ground with 1 mm screen mill. Five quality traits (DMD, WSC, ADF, CP and Total Ash) were estimated using wet chemistry and near infrared spectroscopy (NIR). Details of the methodology and calibrations of NIR are given by Jafari et al. (2003). Collected samples were analyzed using a factorial experiment for species, phenological stages, and interaction effects between species and phenological stages. All statistical analyses were conducted by MINITAB 15.

**Results and discussions** Results showed the significant effects for species, phenological stages and species × phenological stage interactions for all quality parameters. Percent CP, DMD, and total ash were highest when the plants were in vegetative stage and tended to drop sharply with advancing maturity (Figure 1 and 2). Average values of CP and DMD were 11.9 to 4.4 and 53.4 to 39.1 at vegetative and seed ripening stages, respectively. In contrast, percent ADF and WSC were increased by advancing maturity from 10.8 to 13.6 and 44.1 to 60.9 at vegetative and seed ripening stage, respectively. The effects of species were significant for all quality traits (Table 1). Percentage CP was higher for *Coronilla varia* (14.9%) than for other species. *Thymus kotschyanus* the highest values for both DMD and WSC (Table 1). Species × phenological interaction effects were significant for all of quality traits. *Coronilla varia* always had higher values for CP than other species in all phenological stages. The decline of CP in *Dactylis glomerata* was less as compared to other species with advancing maturity from vegetative to flowering stage. However, its CP% declined sharply advancing to the ripening stage (Figure 1). *Achillea millefolium*, *Dactylis glomerata*, *Artemisia aucheri*, *Scariola orientalis* had the highest values for DMD at the vegetative stage and then declined sharply as the plants advanced to the milky stage. However, their values were consistently high for 2 other phenological stages (Figure 2). For *Centaurea virgata*, the decline of DMD was less as compared to other species with advancing maturity. This species had higher values of DMD in ripening stages.



**Figure 1** The effects of phenological stages on CP% in species.



**Figure 2** The effects of phenological stages on DMD% in species.

### References

- Fahey, G. Jr. 1994. Forage quality, evaluation and utilization. ASA, CSSA, Madison, Wisconsin, USA.
- A. Jafari, V. Connolly, A. Frolich and E.J. Walsh (2003). A note on estimation of quality parameters in perennial ryegrass by Near infrared reflectance spectroscopy. *Irish journal of agricultural and food research* 42 : 293-299.

**Table 1** The quality parameters for 9 range species. Means followed by the same letters in are not significantly different according to DMRT.

Species name	CP%	DMD	ADF	WSC	Ash
<i>Achillea millefolium</i>	7.3 c	45.7 d	49.3 d	12.3 d	4.5 d
<i>Centaurea virgata</i>	6.7 d	45.7 d	50.0 d	14.9 b	4.3 d
<i>Coronilla varia</i>	14.9 a	48.2 b	58.2 a	13.9 c	7.3 a
<i>Agropyron intermedium</i>	6.2 e	45.4 d	52.0 c	13.7 c	5.9 c
<i>Bromus tomentellus</i>	6.7 d	45.3 d	54.5 b	8.2 g	6.5 b
<i>Dactylis glomerata</i>	8.5 b	47.5 b	51.8 c	9.5 f	7.5 a
<i>Artemisia aucheri</i>	8.8 b	46.8 c	49.7 d	10.5 e	6.6 b
<i>Scariola orientalis</i>	6.5 d	45.0 d	54.7 b	10.5 e	6.5 b
<i>Thymus kotschyanus</i>	6.7 d	49.5 a	50.0 e	15.8 a	7.3 a