

## Factor analysis of components of yield and quality traits in lucerne (*Medicago sativa*)

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**Introduction** Lucerne (*Medicago sativa*) originated from Iran and is one of the most important forage species in this country. The improvement in yield and quality traits are important objectives in breeding programmes. Smith *et al.* (1997) indicated that in the context of dairy production ranked digestibility was the most important criterion whilst high crude protein and low fibre content were of moderate priority. This study sought to determine the dependence relationships between yield, morphological and quality traits in 64 genotypes.

**Materials and methods** Sixty four lucerne genotypes were planted at Sept. 2000 at Alborz research center, Karaj, Iran, using a simple lattice (8×8) with two replicates. In each plot, six individual plants of each genotype were allocated in 40×40 cm spacing. Data were collected and analysed for 3 harvests of each of 2 years for plant height, tiller number, growth score, dry matter yield (TDM), plant stand, flowering date, plant diameters and leaf stem ratio (LSR). Crude protein (CP), dry matter digestibility (DMD), water soluble carbohydrates (WSC), crude fibre (CF) and acid detergent fiber (ADF) were measured using near infrared spectroscopy. Phenotypic correlation was determined between traits. Estimation of factor loading was based on data averaged over cuts and replications on 13 characteristics of 64 genotypes. The number of factors was estimated using principal components extraction and varimax rotation method.

**Results and discussion** Table 1 illustrates the changes in mean expression of average values for yield, morphological and quality traits. There was significant variation among genotypes for all traits. For TDM, mean values were relatively small, but standard deviation was large. There were strong positive correlations between TDM and tiller number, growth score, plant stand, plant height and plant diameter (data not shown), in agreement with Jafari *et al.* (2003). There were negative and significant relationships between DMD and plant growth, stand, plant height, plant diameter, CF and ADF. The relationships between DMD with CP and LSR were positively significant. Some 64% of total variance was accounted for in the first three factors. The loading of factors indicate the contribution of each variable (Table 2). Factor 1, which accounted for 35% of variation, was strongly associated with quality traits and considered as the quality factor with CP and DMD having negative and CF and ADF positive loading. Factor 2, which accounted for about 20% of variation, was named as the productivity factor, since it included several traits which are components of TDM, all with positive loading. The third factor was named as phenology factor, since it contained flowering date. The negative relationships between flowering date and LSR indicate that late maturity genotypes had lower LSR. These results indicated that selection of variables for the productivity factor could enable breeders to increase forage yield of lucerne.

**Table 1** Mean, standard deviation, maximum and minimum of evaluated traits

Trait	Mean	Std	Min	Max
Tiller number	26.1	6.5	10.3	40.7
Plant growth	34.6	7.5	15.4	50.9
Plant stand	3.24	0.48	1.82	4.09
Plant height	50.3	4.9	34.8	61.4
TDM (t/ha)	9.6	1.6	4.4	13.3
50% flowering	68.0	3.0	62.4	74.3
Plant diameter	32.3	5.4	20.0	41.3
CP %	18.9	1.4	15.7	22.1
DMD %	65.4	3.4	59.2	73.4
LS	1.04	0.11	0.75	1.34
WSC %	12.9	0.8	10.8	14.6
CF %	37.7	2.1	31.3	41.5
ADF %	43.6	2.8	37.1	49.2

**Table 2** Factor matrix after varimax rotation and total variance explained for each factor on 64 alfalfa genotypes

Trait	Factors			Comm.
	F1	F2	F3	
CP %	<b>-0.81</b>	-0.26	-0.07	0.73
DMD %	<b>-0.96</b>	-0.11	-0.04	0.93
CF %	<b>0.95</b>	0.07	0.03	0.90
ADF %	<b>0.92</b>	0.06	-0.01	0.85
Tiller number	0.04	<b>0.69</b>	-0.34	0.60
Plant growth	0.32	<b>0.54</b>	0.31	0.49
Plant stand	0.21	<b>0.65</b>	-0.16	0.49
Plant height	0.13	<b>0.86</b>	0.12	0.77
TDM (t/ha)	-0.06	<b>0.77</b>	0.31	0.69
Plant diameter	0.14	<b>0.58</b>	-0.28	0.44
50% flowering	0.12	-0.31	<b>0.51</b>	0.36
LSR	-0.28	-0.15	<b>-0.65</b>	0.52
WSC %	-0.30	-0.04	<b>0.54</b>	0.41
% of variance	35	20	10	

### References

- Jafari, A., M. Nosrati Nigjeh & H. Haidari Sharifabad (2003). Comparison of yield, morphological and quality traits in 18 ecotypes and varieties of alfalfa (*Medicago sativa*) grown under irrigated and non-irrigated conditions. *Proceedings of the Seventh International Rangelands Congress*, 1403-1405.
- Smith, K. F., K.F.M. Reed & J.Z. Foot (1997). An assessment of relative importance of specific traits for the genetic improvement of nutritive value in dairy pasture. *Grass and Forage Science*, 52, 167-175.