

In the name of Allah

بنا م خدا

ASPECTS OF PRODUCTIVITY,  
MORPHOLOGICAL CHARACTERISTICS  
AND NUTRITIVE VALUE OF TWO  
NATIVE AND FOUR INTRODUCED  
CULTIVARS OF ALFALFA<sup>1</sup>

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خصوصیات تولیدی، مورفولوژیکی  
و ارزش غذایی دو رقم داخلی و چهار رقم  
خارجی یونجه

عوض کوچکی و عبدالحسین ریاضی همدانی  
استادیاران بخش زراعت دانشگاه مشهد

ABSTRACT

خلاصه

Two native (Yazdi and Hamadani) and four introduced (Ranger, Moapa, Messasirsa and Elyonico) alfalfa (*Medicago sativa* L.) cultivars were compared in a field trial in north-east Iran (Mashhad). A Latin square design was used to evaluate the cultivars in terms of productivity, botanical characteristics and nutritive value. The highest proportion of leaf in dry matter occurred in Hamadani and Ranger. The proportion of stem in dry matter ranged from 47 to 51%. Yazdi, Hamadani and Moapa had very high, while Ranger had low proportion of stem. Significant differences were found between cultivars in number of internodes per plant.

Ranger and hamadani recorded the highest cell wall digestibility among the cultivars. Yazdi (19.0%) and Moapa (19.8%)

had the lowest and Ranger the highest (21.3%) protein content. Dry matter digestibility, percent cell wall and the number of stems per unit area did not differ significantly among the cultivars.

در یک آزمایش مزرعه‌ای که در شمال شرقی ایران (مشهد) انجام گرفت دو رقم محلی (یزدی و همدانی) و چهار رقم خارجی یونجه (رنجر، مویا، مساسیرسا، و الیونیکو) مورد مقایسه قرار گرفتند. برای ارزشیابی ارقام از نظر تولید، خصوصیات مورفولوژیکی و ارزش غذایی از یک طرح مربع لاتین استفاده گردید. بالاترین نسبت برگ در ماده خشک در همدانی و رنجر مشاهده شد. نسبت ساقه در ماده خشک بین ۴۷ تا ۵۱٪ بود. ارقام یزدی، همدانی و مویا دارای نسبت بالاتر رنجر دارای نسبت پائینتر از ساقه بود. در بین ارقام، تفاوت معنی‌داری از نظر تعداد میان گره در هر گیاه وجود داشت.

ارقام رنجر و همدانی بالاترین میزان قابلیت هضم دیواره سلولی را دارا بودند. ارقام یزدی (۱۹/۰٪) و مویا (۱۹/۸٪) پائین‌ترین و رنجر بالاترین (۲۱/۳٪) مقدار پروتئین را داشتند. در ارقام مختلف قابلیت هضم ماده خشک، درصد دیواره سلولی و تعداد ساقه در واحد سطح تفاوت معنی‌داری نشان ندادند.

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## INTRODUCTION

Alfalfa is one of the most important forage crops in Iran and is well adapted to a wide range of climatic conditions. The geographic center most often mentioned as the home of alfalfa is Iran (5), although many cultivars have been introduced from different countries. These cultivars, though not always superior to the native ones, have spread all over the country.

Little has been published on the morphological characteristics, adaptability, productivity and nutritional value of alfalfa in Iran. The present investigation includes cultivars recommended to the farmers by the Department of Agriculture, although these cultivars have not been assessed previously and their recommendation has not been based on a thorough and careful examination.

Alfalfa provides a high potential for nitrogen fixation in soils and nutritive value to ruminants (2, 4). Recent estimates put the animal intake of alfalfa 20 to 30% higher than grasses of the same digestibility (2). Since yield of digestible nutrients in many respects is a better index of productivity than the yield of dry matter (11), they must form the basis of any system of forage evaluation. Dry matter digestibility, cell wall or cell content, and cell wall digestibility have been used to evaluate the nutritive value of feedstuff. Digestibility is considered to be a measure of energy value (7) and cell wall or cell content and cell wall digestibility are highly related to animal intake (9, 14). The objectives of this study were to evaluate two native and four introduced cultivars of alfalfa in terms of productivity, morphological characteristics and nutritive value.

## MATERIALS AND METHODS

This experiment was conducted at Torogh Agricultural Station, Mashhad, on a clay loam soil with pH 7.8. Two native

(Yazdi and Hamadani) and four introduced (Ranger, Moapa, Messasirsa and Elyonico) cultivars of alfalfa were sown on 9 May 1977 at rates of 29 kg seed/ha. The experimental design was a 6 x 6 Latin square and the plot size was 2.5 x 3 m. Seed was drilled on rows 40 cm apart.

Harvesting was done at early flowering stage (2-3% flowering) using a hand scyth. The herbage from 3 middle rows was weighed. Herbage samples of 500 g fresh weight were taken for determination of dry matter content and subsequent chemical analyses. Separate fresh samples of approximately 150 g were collected for separation into leaf, stem and flower. These fractions were subsequently oven-dried and weighed.

Stem counts were made in the stubble of all plots following harvest using two random throws of a 15 x 15 cm quadrat per plot. Prior to harvesting, heights of two plants in each plot were measured and the number of internodes for those plants were counted. The experiment was repeated twice and chemical analyses were carried out only for the samples from first harvest year. Number of cuts for the first and the second harvest year were 4 and 7, respectively. The first cut in 1977 was done in June 25 and in 1978 in April 23. The interval between each cut was approximately 3 weeks.

Nitrogen content was determined by the Kjeldahl method and digestibility was measured by the method of Tilley and Terry (13). Method of Van Soest and Wine (15) was used for cell wall determination. Cell wall digestibility was based on the method of Van Soest (14).

#### RESULTS AND DISCUSSION

Hamadani had slightly less dry matter content than other cultivars (Table 1). Yield of dry matter was highest in Yazdi and Elyonico and lowest in Hamadani, Messasirsa and Ranger. Yazdi outyielded Moapa, but there was not much

Table 1. Yield and botanical characteristics of six alfalfa cultivars (average of 1977 and 1978 yields).

Cultivar	Dry matter content (%)	Dry matter yield (kg/ha)	Leaf (%)	Stem (%)	Flower (%)	Inter-nodes/plant	Plant height (cm)	Stems/225 cm <sup>2</sup>
Hamadani	19.0	12558	49.1	50.2	0.7	8	48.8	44
Yazdi	20.1	15347	47.0	50.0	3.0	10	57.4	41
Elyonico	19.8	14493	48.8	49.2	2.0	9	56.9	45
Messasirsa	20.2	13404	47.1	49.2	3.7	9	55.3	40
Moapa	20.4	14334	46.0	51.2	2.8	9	59.3	43
Ranger	19.8	13048	51.1	47.4	1.5	9	50.2	44
ISD <sub>5%</sub>	0.6	970	1.6	1.2	1.2	0.5	2.4	6
ISD <sub>1%</sub>	0.9	1322	2.2	1.7	1.6	0.6	3.2	9

difference between Moapa and Elyonico. Yield of dry matter for Yazdi averaged 15347 kg/ha. This seems to be rather high under this condition.

The proportion of leaf in dry matter was in the range of 46 to 51% (Table 1). Ranger and Hamadani had high, while Moapa, Messasirsa and Yazdi had low leaf proportion. High proportion of leaf is essential for high animal intake (6). Where high production per animal is required, it seems important to ensure ready access to an abundant supply of leaf. If production per hectare per year is to be satisfactorily high, it is important to know how to provide a high annual per hectare yield of green leaf which can be consumed without having to intake too much mature stem (16). Proportion of stem in dry matter was lowest in Ranger. Less than 1% of dry matter yield in Hamadani was comprised of flowers, whereas this value for Messasirsa was almost 4%. There was not much difference in proportion of flower between cultivars. Since Hamadani is a rather late maturing cultivar and has a slow recovery after each cut, low proportion of flower in dry matter is not unexpected.

Number of internodes per plant was highest for Yazdi and lowest for Hamadani. There was no difference between other cultivars in this regard. Moapa and Yazdi had the tallest crop and Hamadani and Ranger the shortest. This could be attributed to a rather late maturity of the last two cultivars. It seems that height of crop at the time of harvest is mostly due to internode elongation and not necessarily to an increase in the number of internodes. Number of stems per unit area for the cultivars did not differ significantly.

From Table 2 it can be seen that cultivars Yazdi and Moapa had the lowest protein content (19.0 and 19.8%, respectively) and Ranger the highest (21.3%). This may, to some extent, be related to the higher proportion of leaf in dry matter for the latter cultivar (Table 1). However,

Table 2. Chemical composition of six cultivars of alfalfa (1977 data only).

Cultivar	Protein content (%)	Dry matter digestibility (%)	Ash free cell wall (%)	Cell wall digestibility (%)	Yield of digestible dry matter (kg/ha)
Hamadani	20.5	70.6	32.3	52.1	5569
Yazdi	19.0	68.8	32.8	43.9	6283
Elyonico	20.9	70.4	31.1	45.2	6138
Messasirsa	20.5	69.9	31.9	44.4	5884
Moapa	19.8	69.1	32.4	43.5	5890
Ranger	21.3	71.0	31.0	51.8	5412
ISD <sub>5%</sub>	0.7	1.5	1.4	6.9	539
ISD <sub>1%</sub>	1.0	2.0	2.0	8.1	735

a similar trend was not observed for other cultivars. Protein content of all cultivars was well above the suggested level for ruminants (1, 12).

There was no significant difference either in dry matter digestibility or in percent cell wall (and hence percent cell content) between cultivars. This was true in spite of the fact that proportion of leaf in dry matter for some cultivars was 5% higher than the others. A lack of relation between digestibility and leaf percentage has been reported by others (8, 11).

Yield of digestible dry matter had the same pattern of change as that of the yield of dry matter probably because digestibility of these cultivars did not differ significantly.

Cell wall digestibility for Hamadani was highest among the cultivars. This may be related to morphological characteristics associated with the higher proportion of leaf and hence a lower proportion of lignin in the cell walls. Lignin has been found to protect other cell wall constituents physically or chemically from bacterial attack (3, 10).

The native cultivars were comparable and in some cases superior to the introduced ones. Therefore, assuming that seeds of native cultivars are as available as the introduced ones, there is no advantage in growing the introduced cultivars.

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