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Evaluation of Three Exotic Legume Species for Fodder Potential

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Abstract: Tropical fodder legumes not only provide superior fodder but also increase the soil fertility due to nitrogen fixing bacteria. For production of fodder during summer, three exotic fodder species, *Lablab purpureus*, *Vigna umbellata* and *Macroptilium lathyriodes* imported from Plant Introduction Station of U.S.A. were evaluated for quality and yield. These crop species were observed carefully and described morphologically. Herbage yield was more than cowpea and significant among all the species, hence could be used as forage crop. Crude protein, ether extract and crude fibre were higher in *Macroptilium*, whereas herbage yield was significantly higher in lablab bean. Correlation coefficients were different for various crop species which revealed that improvement might be possible through collection and selection for desirable traits, especially in lablab bean which exhibited high correlation between herbage yield and quality characters.

Key words: Forage, tropical legumes, yield

Introduction

Use of legumes in pastures fur the grazing animals has not an old history. The early development and use of temperate legumes such as clover, trefoils and lucerne took place close to the centres of origin of these plants in Europe arid Mediterranean region. A vast knowledge of the performance of these species has been exploited in restricted high altitude areas of tropical countries where climatic conditions allow their satisfactory growth. The use at tropical legumes species has not yet been exploited up to the potential. In Pakistan, shortage of green fodder is one of the limiting factor to maintain present livestock population (Anonymous, 1999). The shortage is about 40 to 50% in green herbage which reaches up to 75% in lean periods (Ahmad, 1992). At present, total area under fodder crops is 2.8 million hectares with a national average yield 01 20.4 tones per hectare (Anonymous, 1997). Pakistan has about 21 million hectares of cultivable area but due to shortage of food, arable crops are cultivated even on marginal lands and as such the land cannot be shifted permanently to forage crops. In such conditions, the evolution of high yielding, especially the leguminous fodder crops is the dire necessity in bridging the production-demand gaps especially for the scarcity periods.

In Pakistan, only few fodder legumes like Cowpea (*Vigna unguiculata*) and Guar (*Cyamopsis tetragonoloba*) are grown on very small acreage. As such, there is a need to exploit nee (odder legumes which are not only good source of proteins but also provide higher herbage yield than the traditional fodder crops. Risopoulos (1966) and Stobbs (1969a, b) reported from their studies conducted in Zaire and Uganda respectively that introduction of legumes crops as animal fodder not only increased the weight of livestock but also provided the greatest margin of profit. To provide the balanced diet to livestock, there is need to identify some tropical fodder legumes which are not only the superior fodder legumes but also increase the soil fertility. Similarly during early winter months (November and December) supply of fodder is scarce because summer crops are over while winter fodder are riot yet available.

Materials and Methods

The seeds of lablab bean (*Lablab purpureus*), rice bean *umbellata*) arid phasey bean (*Macroptilium lathyroides*) were imported from Plant Introduction Station of United States Department of Agriculture, Beltsville, MD. The seeds were planted under field conditions at National Agricultural Research Centre, Islamabad during July for three consecutive years in rows spaced 50 cm apart, The plants for herbage yield and chemical analyses were harvested at 50% flowering in lablab bean and rice bean while in phasey bean as the flowering is not uniform, the plants were harvested in early November when the plants attained their maximum vegetative growth. The proximate chemical composition of the oven dried (60°C) samples was carried out according to the methods of AOAC (1990). The cell wall constituents, i.e., NDF, ADF, cellulose, hemicellulose, lignin and cutins were determined by the methods as described by Georing and van Soest (1970). The *in situ* dry matter digestibility was determined using the nylon-bag technique as described by Orskov *et al*. (1980).

Results and Discussion

As all three species are exotic in origin, so their morphological description is given below:

Lablab purpureus **(lablab bean):** Rampant and vigorously twining herbaceous, stems robust, 3 to 6 m, leaves trifoliate, leaflets broad ovate rhomboid, 7.5 to 15 cm long, thin, acute at apex, smooth above and shortly hairy underneath. Inflorescence lax, fascicled, of many flowered racemes on elongated peduncles. Flowers may be white or purple but as fodder, white flowered genotypes are recommended as purple flowered genotypes emit pungent smell making it undesirable by animals. Pods 4 to 5 cm

Table 1: Mean values along with standard deviation and analysis of variance in three species tested for fodder suitability

	Crop species			
	Macroptilium	Lablab bean	Rice bean	MS (species)
Dry matter[1]	95.43±2.33	95.06±3.56	95.17±2.17	0.11
Crude protein	16.54±1.84	15.76±3.16	13.07±0.73	9.91**
Ether extract	3.05±0.51	2.24±0.31	2.48±0.79	0.51
Crude fibre	20.75±2.06	19.33±1.53	19.17±1.13	2.27
Ash	5.71±0.95	7.45±0.96	7.39±1.23	2.92
Nitrogen free extract (NFE)	53.95±2.58	55.22±2.76	57.88±1.06	12.09
Neutral detergent fibre (NDF)	38.36±2.87	40.09±2.31	40.31±2.30	3.41
Acid detergent fibre (ADF)	26.31±3.00	28.01±0.92	28.10±1.87	3.04
Hemi-cellulose	12.05±1.38	12.02±1.63	10.20±1.52	3.39
Cellulose	16.39±2.06	16.93±1.65	31.77±2.67	228.43**
Lignin±Cutin	5.73±0.98	6.34±0.22	9.91±1.42	15.28**
In-situ dry matter digestibility	49.04±3.01	48.93±2.76	52.24±4.84	10.58
Herbage yield	47.80±5.90	58.23±6.56	33.25±2.45	966.70**

- percentage of dry matter of already oven dried samples at 60-65°C. ** is significant at 0.01 level.

Table 2: Correlation among 13 traits related to fodder quality of three crop species

	DM	CP	EE	CF	Ash	NFE	HY	NDF	ADF	HC	C	L C
Macroptilium CP	0.00											
Lablab bean	-0.98											
Rice bean	0.96											
Macroptiliurm EE	-0.37	-0.93										
Lablab bean	-0.99	0.98										
Rice bean	0.13	-0.15										
Macroptilium CF	-0.93	0.37	0.00									
Lablab bean	-0.98	0.99	0.99									
Rice bean	-0.57	-0.31	-0.89									
Macroptilium Ash	0.99	-0.06	-0.31	-0.95								
Lablab bean	0.92	-0.98	-0.95	-0.94								
Rice bean	0.09	-0.20	0.99	-0.87								
Macroptilium NEE	0.67	-0.74	0.44	-0.90	0.72							
Lablab bean	0.99	-0.99	-0.98	-0.99	0.94							
Rice bean	0.33	0.05	0.98	-0.96	0.97							
Macroptilium HY	0.95	0.31	-0.64	-0.77	0.93	0.41						
Lablab bean	-0.98	0.97	0.99	0.99	-0.89	-0.99						
Rice bean	-0.29	-0.55	0.91	-0.62	0.93	0.81						
Macroptilium NDF	-0.89	0.46	-0.10	0.99	-0.92	-0.94	-0.70					
Lablab bean	-0.29	0.47	0.38	0.37	-0.65	-0.34	0.23					
Rice bean	0.20	0.47	-0.95	0.69	-0.96	-0.86	-1.00					
Macroptilium ADF	-0.78	0.63	-0.30	0.95	-0.82	-0.99	-0.54	0.98				
Lablab bean	-0.89	0.96	0.93	0.93	-0.98	-0.92	0.86	0.69				
Rice bean	-0.40	-0.12	-0.96	0.98	-0.95	-0.99	-0.76	0.82				
Macroptilium HC	-0.98	0.04	0.33	0.94	-0.99	-0.70	-0.94	0.91	0.80			
Lablab bean	0.86	-0.75	-0.81	-0.82	0.58	0.83	-0.89	0.23	-0.54			
Rice bean	0.16	0.43	-0.96	0.72	-0.97	-0.88	-0.99	0.98	0.84			
Macroptilium C	-0.81	0.58	-0.24	0.97	-0.85	-0.98	-0.59	0.99	0.98	0.84		
Lablab bean	-0.99	0.98	0.99	0.99	-0.97	-0.99	0.97	0.44	0.95	-0.77		
Rice bean	0.50	0.72	-0.80	0.43	-0.82	-0.66	-0.97	0.95	0.60	0.94		
Macroptilium L+C	0.02	-0.99	0.92	-0.38	0.08	0.75	-0.30	-0.47	-0.64	-0.05	-0.59	
Lablab bean	-0.79	0.66	0.73	0.74	-0.48	-0.76	0.83	-0.35	0.44	-0.99	0.68	
Rice bean	-0.21	0.08	-1.00	0.92	-0.99	-0.99	-0.88	0.92	0.98	0.93	0.75	
Macroptilium DMD	-0.53	0.85	-0.60	0.80	-0.58	-0.98	-0.23	0.86	0.94	0.56	0.92	-0.86
Lablab bean	-0.96	0.99	0.98	0.98	-0.99	-0.97	0.94	0.55	0.98	-0.69	0.99	0.59
Rice bean	-0.12	-0.40	0.97	-0.75	0.98	0.90	0.99	-0.98	-0.86	-0.97	-0.92	-0.95

DM- dry matter, CP- crude protein, EE-fibre, ADF- acid detergent fibre, -1-1C- ether extract. CF- crude fibre, hemi-cellulose, C- cellulose, NFE- nitrogen free extract, HY- herbage yield, NDF- neutral detergent L±C- lignin±cellulose, DMD- in-situ dry matter digestibility.

long, containing 2-4 seeds. It is considered drought tolerant and high yield potential crop (Rabbani and Ahmad, 1990).

***Macroptilium lathyroides* (plummy bean):** It is herbaceous annual or short lived perennial erectly branching, 0.5 to 1.5 m tall. Branches terete clothed with long deciduous refluxed hairs. Leaflets ovate or lanceolate, 3.5 to 7.5 cm long. Inflorescence racernes about 15 cm long borne on axillary peduncles up to 25 cm, pedicles short. Flowers red purple, pods sub-cylindrical 7.5 to 10 cm long and 3 mm wide, approximately 20 seeds per pod. It originated in tropical America and is now widespread and naturalized in the tropics. It is resistant to water logging and salinity.

Vigna umbellate trice bean): Commonly known as rice bean, is a summer growing herbaceous annual twirling, stews robust 0.5 to 3 m long, leaves trifoliate, leaflets broad ovate-rhomboid-acute at the apex, 4-5.5 cm long. It bears clusters of 5-20 bright yellow flowers that produce narrow pods often in cluster up to 12. Pods 4 to 6 cm long and rounded, 4 to 10 seeds in one pod. Seed coat is yellowish, green or blackish and seed size similar to rnungbean. Once seedings are established, it is resistant to water logged conditions (Ahmad and Rabbani, 1992).

Evaluation for quality and yield potential: The herbage yield and proximate chemical composition of three legume species investigated under this study is given in Table 1. The maximum herbage yield was obtained in lablab bean followed by phasey been and rice bean. The differences were statistically significant for crude protein, cellulose, lignin + cutin and herbage yield among three species under investigation, whereas all other characters were insignificant. These legumes could equally be used for forage crop as most of the chemical features were insignificant among three species. All these three fodder legumes produced more herbage yield than cowpea, a traditional summer fodder crop of Pakistan as Bhatti *et al*. (1983) have reported that maximum yield of 27.2 tones per hectare was recorded in a cowpea variety P-76. Regarding crude protein and digestibility, these legumes are at par with other traditional fodder legumes and superior to grasses (Skerman, 1977). Among 13 parameters relating to yield and quality investigated for present material, four traits (crude protein, cellulose, lignin + cutin and herbage yield) were observed statistically significant. For all other trails, all the three crop species could be considered important for fodder production. Correlation among 13 traits were also investigated for three fodder legumes arid presented in the Table 2. It is obvious from the results that correlation coefficients among various traits were different in the crop species under study. Improvement for various traits could be possible through collection and simultaneous selection of a broad based germplasm of these crops. Positive correlation of herbage yield with most of the quality traits in lablab bean gave an indication for improving herbal yield without loosing quality.

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