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Growth Characters and Yield of Some Selected Lines of Grass Pea (*Lathyrus sativus*)

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Abstract. The grass pea (*Lathyrus sativus*) is a dual purpose forage seed legume crop. It has a good potential as winter forage legume under Saudi Arabian conditions. This study was conducted in 1993/94 and 1994/95 seasons to evaluate 15 selection lines of the Grass Pea for forage, seed yields and other growth characters. Combined analysis of data from the two years revealed significant difference between years. However, year × selection line interaction was significant only for days to flowering. Significant differences were observed among the selection lines for days to flowering, plant height, biological yield and harvest index. The selected line 519 had the highest biological yield, 4681 kg/ha, and was among the best lines in seed yield, 885 kg/ha. Several other selection lines were also very productive both in seed and biological yields such as 520 and 531, while the lines 522 and 527 had high biological yields only. These lines have a good potential as winter forage legumes under Riyadh area conditions. The selected lines 508, 528 and 530 have a good potential for seed yield only.

Introduction

The grass pea (*Lathyrus sativus*), known as common chickling, is an annual cool season legume grown for both forage and seed yield [1, p. 505-506]. It has a good potential as grain legume for animals and humans. However, the presence of the potent toxin β-N-oxalylamino-L-alanine or β-N-oxalyl-α, β diamino propionic acid, which causes lathyrism has restricted its use as a grain legume. In spite of this obvious health hazard, the grass pea continues to be preferred by some poor farmers in India and central Asia [2]. The attraction of *Lathyrus* in these regions derives from its ease of cultivation, drought tolerance, low fertilizer requirements, high resistance to pests and reasonably good yields.

Lathyrus sativus is cultivated as forage crop in the Mediterranean region and sub-tropical countries in Africa, Asia and the Pacific [3, p. 554-558; 4]. It is a highly nutritious species that contains 31.6% crude protein which adds to its nutritional value [2]. Cerci and Ozer [5] reported an increase in sheep food intake and digestibility of DM, crude ash, organic matter, crude fiber, and crude protein with increasing dietary of grass pea. Research on grass pea has increased since the development of lines that are very low in the neurotoxin β-N-oxalyl-α- β diamino propionic acid [6]. The International Center for Agriculture Research in Dry Areas (ICARDA) has launched a coordinated multidisciplinary research on grass pea and other small grain legumes to increase its utilization in agriculture both as seed and forage legume [2].

The objectives of this study were to evaluate some selection lines of *Lathyrus sativus* for seed and forage yield ability and to select the lines that are more adaptable to the central region of Saudi Arabia. It is part of an attempt to select new cool season forage crops to provide forage yield during winter and early spring when alfalfa forage production is low.

Materials and Methods

Two field experiments were conducted at the College of Agriculture Experimental Research Station at Dirab near Riyadh in 1993/94 and 1994/95 seasons. The site of experiment was a sandy loam soil (clay 11%). A randomized complete block design (RCB) with three replicates was used in both years. Fifteen lines of *Lathyrus sativus*, obtained from ICARDA, were included in this study. The selection line 587 was introduced from Syria, while the other fourteen lines originated from Ethiopia. The seeds were planted in November in both seasons, at a planting distance of 30 cm between rows. The length of each row was 4.0 m. The seeds were drilled in 4 rows / plot with 40 seeds in each row, the plot area was 4.8 m^2. Super phosphate fertilizer was applied at a rate of 300 kg/ha at planting. Nitrogen fertilizer (in the form of urea 46% N) was added at a rate of 50 kg/ha one week after sowing. Plots were irrigated with treated municipal water whenever needed throughout the growing seasons. Weeds were controlled with an application of pre-emergence herbicides; linuron wp 50% at a rate of 0.25 kg a.i /ha and Pendimethalin 50 EC at a rate of 1 kg a.i /ha.

Seven weeks after sowing plants started to flower. Five months after sowing, pods and seeds were harvested from mature plants from the two middle rows in each plot. The number of days to flowering and the number of days to maturity were recorded. Biological yield (above ground biomass) and seed yield were taken within each plot. Plant height was measured prior to harvest as an average of three randomly selected plants in each row. Harvest index was calculated by dividing seed yield on biological yield and multiplied by 100. Weather parameters recorded included total rainfall and mean temperatures as well as number of days below 0 °C at the time of experiment.

Data for the two years were statistically analyzed using SAS [7] according to Snedecor and Cochran [8].

Results and Discussion

The combined analysis of variance for 1994 and 1995 data revealed that the year effect was highly significant for all characters (Table 1). This may be attributed to unfavorable climatic conditions in the second year, where frost damage with below freezing temperatures were reported on six days during the season. The frost effect generally decreased yield for all lines. Therefore, the year × line interaction was significant only for days to flowering, while for all the characters studied the interaction was not significant (Table 1). It is also indicated from Table 1 that the selection line effect was significant for all characters except for days to maturity and seed yield. This result indicated that despite the differences among selection lines, all entries have responded similarly to the change in environmental conditions. This result was in agreement with findings of Treaches [2].

Table 1. Combined analysis in RCB design for growth characters and yield of some selection lines of *Lathyrus sativus* in 1993/94 and 1994/95

Source of Variance	d.f.	Days to flowering	Days to maturity	Plant height	Seed yield	Biological yield	Harvest index
Year (A)	1	**	**	**	**	**	**
Rep. within year (B)	4	-	-	-	-	-	-
Selection line (C)	14	**	NS	**	NS	*	*
A × C	14	*	NS	NS	NS	NS	NS
Error	56	-	-	-	-	-	-

*, **, NS = Significant at 0.05 and 0.01 levels of probability and not significant, respectively.

Significant differences were observed among growth characters (Table 2). The selection lines 529 and 587 flowered earlier than the other thirteen selections. They flowered after an average of 53 and 54 days respectively. However, Treacher [2] indicated that plants of *Lathyrus sativus* started to flower after an average of 112 days in Syria. It has also been reported that some selected lines of grass pea flower after 208 days [9]. Regarding days to maturity, most selection lines attained maturity within 2 to 3 days from each other. The plants matured after an average of 157-160 days (Table 2). This result agrees with that found by Treacher [2] who indicated that grass pea plants matured after an average of 155 days.

Limited differences were also observed among selection lines in plant height where most lines had an average plant height of 92 to 105 cm (Table 2). However, the selection line 587 had an average plant height of 68 cm and was significantly lower than

any other line. Falco *et al*. [9] indicated that grass pea plants reached only a height of 73 cm. These results indicate that the selection lines of grass pea performed better under the Riyadh area than in Syria which could be due to the warm weather conditions in the Riyadh area.

Very few significant differences were observed in seed and biological yields. Differences among all selected lines for seed yield were not significant except for line 516 which had a low seed yield of 492 kg/ha. Seed yield of most lines ranged between 700 and 838 kg/ha (Table 2). The selected lines 508, 530 and 519 gave the highest seed yield, 915.5, 894.6 and 885.2 kg/ha respectively (Table 2). Significant differences were observed among selected lines for biological yield (Table 2). The selected line 519 was significantly different from most of the other lines producing more forage yield. Treacher [2] indicated that the selection line 508 and 519 produced 1458 and 1293 kg/ha of biological yield and 304 and 321 kg/ha for seed yield respectively when grown in Syria. This means that these selection lines are more adapted to areas with mild winter such as Saudi Arabia.

Table 2. Some growth characters and yield of some selection lines of *Lathyrus sativus* at Dirab (Riyadh) in 1993/94 and 1994/95 seasons

Selection line	Days to flowering	Days to maturity	Plant height (cm)	Seed yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)
504	60.0	157.2	077.3	716.5	3107.6	23
505	59.3	159.3	088.8	737.5	3697.9	20
508	57.0	159.7	100.9	915.5	3793.4	24
510	59.8	160.5	099.9	778.7	3324.7	23
516	61.2	157.7	091.9	492.2	2847.2	17
519	61.2	159.8	104.0	885.2	4680.9	19
520	58.7	159.7	105.3	805.2	3958.3	20
522	58.3	159.7	101.1	736.1	4053.8	18
527	61.8	158.0	100.1	700.9	4010.4	17
528	59.7	159.7	088.9	837.2	3576.4	23
529	52.5	159.2	084.9	745.1	3066.0	24
530	58.5	160.0	091.9	894.6	3602.4	25
531	56.5	156.8	095.0	837.9	3849.8	22
533	59.0	159.2	100.2	809.6	3376.7	24
587	53.8	157.2	067.7	765.6	3602.4	21
$L.S.D_{0.05}$	2.2	NS	15.5	NS	908.3	5

Harvest index reflected the limited differences in seed and biological yields. It ranged from 17 to 25% (Table 2). The selected lines 519, 522, 515 and 527 had the lowest harvest index of 19%, 18%, 17% and 17% respectively (Table 2). A similar result was reported by Treacher [2].

Based on these results, the selected lines of *Lathyrus sativus* generally adapted well to the climatic conditions of Riyadh area especially lines 519, 520, as well as 531 which produced the highest values of seed and biological yield. The lines 522 and 527 had high biological yield only. These lines will be included with other superior lines from other forage species such as *Vicia sativa* in advanced evaluation trials for selection of new winter forage crops adapted to the Riyadh area. The lines 508, 519, 528, and 530 have a potential as seed legume.

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صفات النمو والمحصول لبعض سلالات الجلبان (*Lathyrus sativus*)

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ملخص البحث. يعتبر الجلبان محصولاً بقولياً ثنائي الغرض إذ يزرع من أجل الحصول على البذور والعلف الأخضر. وله إمكانات جيدة كمحصول علف بقولي شتوي تحت ظرف المملكة العربية السعودية. أجريت هذه الدراسة في شتاء موسمي ١٩٩٣م، ١٩٩٤م وذلك لتقييم خمسة عشر سلالة من الجلبان من حيث المحصول البذري والعلفي بالإضافة إلى صفات النمو الأخرى. وقد أظهر التحليل المجمع لبيانات الموسمين فرقاً معنوياً بين الموسمين مع أن التفاعل بين السنة والسلالة كان معنوياً فقط لصفة عدد الأيام حتى التزهير. وقد لوحظ فروق معنوية بين السلالات لصفات عدد الأيام حتى التزهير، ارتفاع النبات، محصول العلف ومعامل الحصاد. وقد اختيرت السلالات ٥١٩، ٥٢٠ و ٥٣١ بناءاً على تفوقها في المحصول البذري والعلفي. بينما تفوقت السلالات ٥٢٢ و ٥٢٧ في محصول العلف فقط. هذه السلالات لها إمكانات جيدة كمحاصيل علف بقولية شتوية تحت ظروف منطقة الرياض. أما السلالات ٥٠٨، ٥٢٨ و ٥٣٠ فقد تفوقت في محصول البذور فقط.