International Journal of Advanced Research in Biological Sciences

ISSN : 2348-8069

www.ijarbs.com

Research Article

Relationship between protein content, seed size and days to flowering in Lentil (*Lens culinaris* Medik)

Jyoti Kumari*, H K Dikshit, Dayachand, M Aski and Anju M. Singh

Division of Genetics, Indian Agricultural Research Institute, New Delhi-12
National Bureau of Plant Genetic resources, New Delhi-12
*Corresponding author: *jj_gene@rediffmail.com*

Abstract

A total of 105 lentil genotypes consisting of varieties, advanced breeding lines and germplasm lines were evaluated for protein content, seed size and days to 50% flowering. The protein content varied from 20.2 to 31.2 % with the mean value of 24.7%. The seed size varied from 1 to 4.5 gm, the average being 2.45 gm and the genotypes under study flowered from 62 to 89 days. The correlation coefficient was estimated between protein content, seed size and days to flowering. The correlation coefficient between protein content and seed size was -0.12. Days to flowering is negatively correlated with seed size while there was no significant association with protein content. The R^2 value was found non-significant by its f value 0.18 showing that there is no clear cut relationship between seed size and protein content.

Keywords: Lentil, Protein content, seed size

Introduction

Lentil is an important cool season legume crop after chickpea in south-east Asia, some parts of Europe, Australia and Canada. Lentil is gaining importance in India which is evident by increase in area thrice and production twice in last 25 years. Lentil has both small seeded as well large to extra-large seeded cultivars. The major area expanded under lentil is mainly for large seeded cultivars which had doubled in last 3 decades. Seed proteins are of prime importance in human and animal nutrition. In order to harvest more protein of improved quality, genetic improvement of seed proteins has attracted considerable attention. For genetic improvement of varieties, knowledge of variation for protein content in the genetic resources is essential. In general small seeded genotypes have more protein content than large-seeded in several crops (Saxena *et al.,* 1987). In pulses, the reports are varying. There is no clear association between seed size and protein content as per Tyagi and Sharma, 1995 in lentil and Sandhu *et al.* (1989) in chickpea.

Protein content varied from20.4 to 28.3% in a sample of 32 genotypes (Tyagi and Sharma, 1995). They observed positive(r=0.26) but statistically non significant correlation between seed size and protein content. Hamdi et al, (1991) analyzed 3663 germplasm accessions from all lentil growing regions and recorded a range of 25.7 to 29.8% seed protein. The correlation observed was 0.17. Hamdi et al., 1991, Chauhan and Singh, 1995, Tyagi and Sharma, 1995 reported the quantitative inheritance of this trait.

Furthermore, lentil is mainly grown in rainfed areas in rice fallows particularly in North-Eastern plain zone, Jharkhand and Chhattisgarh region, where the early maturing cultivars are more popular. Therefore, the duration of flowering and maturity are also important to know whether the flowering time also affects protein development process in the seed. Therefore present study was conducted to find the relationship between seed size, days to 50 % flowering and protein content as well as to identify contrast parents to study the genetics of this trait and develop mapping population.

Materials and Methods

A total of 105 lentil genotypes consisting of varieties, advanced breeding lines and germplasm lines were grown at research farm of IARI, Pusa Campus, New Delhi in year 2007-08 in augmented design. All genotypes were evaluated for days to 50% flowering, seed size and protein content. Days to 50% flowering was recorded on plot basis. Seed size was calculated for 5 replicates. The grain protein content was determined using the Foss-Tecator Kjeltech system which is based on the kjejdahl method at Cereal Laboratory, Division of Genetics, IARI. The samples were analyzed with 0.5 gm of the grain flour from each three replicates taken from all entries. After digestion and distillation steps, titration was done to obtain organic nitrogen content, which by multiplying with 6.25 gave the quantity of % grain protein. Arcsine transformation was used for transforming protein data. ANOVA was obtained for all traits following Statistical package of augmented design. The Pearson correlation coefficient and regression plot was analyzed between seed size and protein content by SPSS 10.0 statistical software. The Pearson correlation coefficient and regression plot was analyzed between seed size and protein content by SPSS 10.0 statistical software.

Results and Discussion

Out of 105 genotypes 10 were of early maturity, 57 of medium maturity and 38 were late maturing more than 80 days flowering time. Twenty five each were small and large seeded and 55 were medium seeded. The protein content analyzed in the lentil genotypes in the present study varied from 20.2 % in genotype L7920 to 31.2 % in genotype L5126 with the mean value of 24.7% and the seed size varied from 1(L830) to 4.5 gm (P1117), the average being 2.45 gm. Days to flowering varied between 62 (L4677) to 89 (SKL259) days with the average being 78.4 days. The correlation coefficient estimated between protein content and seed size was -0.12 (Table 1) and the value was negative but not significant. The R^2 value (0.016) was found non-significant by its “f” value 0.18 showing that there is no clear cut relationship between seed size and protein content (fig 1). L5126, sehore74-3 and DPL58 had protein values more than 30 %, but their seed size varied, DPL 58 had 2.7 gm as 100 seed weight and L5126 and Sehore74-3 were around 1 gm. Similarly low protein content genotypes L7908, LC265-10, L7764, L7913 and L7920 were having varying range of seed sizes. The largest seeded genotype, P1117 and smallest seeded genotype, L830 , had protein content 28.9 and 28.2 respectively.

Table 1. Descriptive statistics and relationships between seed size, protein content and flowering time in lentil genotypes

Parameters	Seed size	Protein content	Flowering time
Mean	2.45	24.75	78.42
Range	0.9-4.45	20.02-31.02	62
CV%	27.27	9.97	89
Seed size			
Protein content	-0.129	1	
Flowering time	0.398	0.063	1

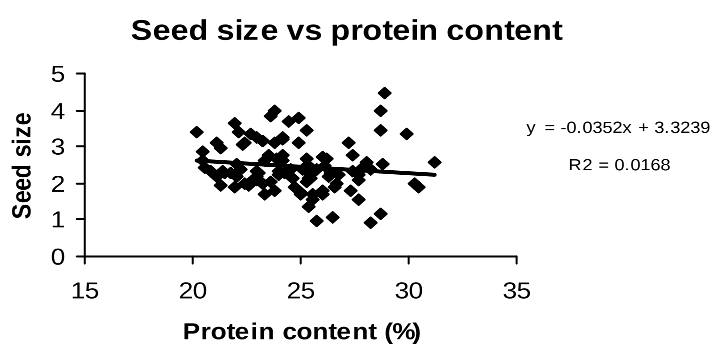

Fig 1: Relationship between seed size and protein content depicted by regression plot

In other crops varying results were obtained. In mungbean there was negative correlation between seed size and protein content (Haque *et al.*, 2003). Sandhu et. al. (1989), in their study with 123 genotypes of chickpea concluded that protein content is largely unrelated to the yield related characters. Similarly Dahiya et al., (1982) reported that correlations between seed protein concentration and seed yield and seed size were very small in chickpea cultivars.

The correlation coefficient between protein content and flowering time was very low 0.063 (Table 1), indicating that protein content does not depend upon floweing time. From the results obtained the genotypes more than 29% protein content (4) and less than 21% protein content (5) can be used as contrasting parents for mapping population development. Similarly for seed size and flowering time, genotypes are mentioned in Table 2. To conclude with as per the result of correlation analysis, protein content can be increased in genotypes irrespective of the seed size and flowering time. The lentil genotypes Precoz, an Argentine cultivar and P1116 (introduction from ICARDA) may be used as source for early maturity, protein content and seed size. The genetic stock L4603 can be used for contrasting parents for protein content and early maturity as well and PL01 for seed size and protein content. To introgress the high protein content into elite cultivars and developing mapping populations L5126 , Sehore 74-3 and DPL 58 can be used as donor and high value parents.

Table 2: Genotypes with highest and lowest scores for protein content, seed size and flowering time

Genotypes with	Protein content (%)		Seed Size(g)		Flowering time(d)	
Highest score	**Precoz**	28.7	L7920	3.40	L404	86
	PL406	28.7	L5125	3.46	DPL-58	86
	PL01	28.7	L7763A	3.64	L4147	87
	L4603	28.8	FLIP96-51	3.69	LC292-21	87
	P1117	28.9	L7903	3.79	L5125	87
	14-1-Y-50	29.9	L7925	3.85	Globe m	88
	DPL-58	30.3	PL01	3.96	PL406	88
	Sehore74-3	30.5	**Precoz**	3.98	L4599	89
	L5126	31.2	**P1117**	4.45	SKN-259	89
Lowest score	L7764	20.5	L830	0.90	L4677	62
	L7913	20.5	L4147	0.96	FLIP96-51	65
	LC265-10	20.6	L331	1.08	ILL8006	68
	L7908	20.8	PL406	1.17	L4603	69
	L7905	21.1	Globe m.	1.38	L5227	70
	L7819	21.1	10-3-Y-26G	1.55	L7763A	70
	LC282	21.3	Fasciated m	1.56	L7913	70
	L4076	21.3	L4596	1.69	LC265-14	70
	L7931	21.4	LC294-29	1.71	14-1-Y-50	70
	L7917	21.5	ILL8006	1.71	**P1117**	70
	L7935	21.8	L4599	1.72	L4605	71
	L7920	21.9	SKN-259	1.74	**Precoz**	71

References

Chauhan M P and Singh I S. 1995. Inheritance of protein content in lentil (*Lens culinaris* edik). *Legume Research* **18**(1): 5-8.

Dahiya B S, Kapoor A C, Solanki I S and Waldia R S. 1982. Effects of Cultivar and Location on Seed Protein in Chickpea (*Cicer arietinum*). *Experimental Agriculture* 18:289-92.

Hamdi A, ErskineW, and Gates P. 1991. Relationships among economic characters in lentil. *Euphytica* 57:109-116.

Haque M M , Afzal M A , Bakr M A , Bashir M M and Nusrat Karim Luna. 2003. Relationship Between Seed Size, Protein Content and Cooking Time of Mungbean [*Vigna radiata* (L.) Wilczek] Seeds**.** *Asian Journal of Plant Sciences*. 14. 1008-9.

Sandhu T S, Gumber R K , Bhullar B S and Bhatia R S. 1989. Genetical analysis of grain protein, grain yield and its components in chickpea (*Cicer arietinum* L.). *Journal of Research, PAU* 26(1): 1-9.

Saxena K B, Faris D G, Singh U and Kumar R V. 1987. Relationship between seed size and protein content in newly developed high protein lines of pigeonpea: *Plant Foods and Human Nutrition*.36(4): 335-40.

Tyagi M C and Sharma B. 1995. Protein content in lentil (*Lens culinaris* Medik). In : Sharms B, KulshresthaVP, Gupta N. and Mishra S K (eds). *Genetic Research and Education: Current Trends and the Next Fifty Years*. Indian Society of Genetics and Plant Breeding, New Delhi, India,pp.1031-34.