



Response of different yield components as selection criteria for yield and yield components in early generations of lentil (*Lens culinaris* L.)

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ABSTRACT

Selected forty F_2 single plant progenies of a lentil cross viz., L-830 \times MC-6 and bulked seeds were evaluated in a randomized block design with two replications for secondary branches per plant, pods per plant, seed yield per plant and seed index as independent selection criteria. Out of the four selection criterion, highest realized selection response in percentage was recorded for pods per plant (37.42 %), and was followed by secondary branches per plant (28.5 %). The realized correlated response to selection for seed yield per plant was significant under the selection criteria number of pods per plant. Thus the selection criteria pods per plant was more effective than other selection criterion.

Key words: Correlated response, Early generation selection, Lentil, Response to selection, Realized selection response.

INTRODUCTION

Lentil is an old world legume and, is considered to be one of the first plant species to be domesticated (Bahl *et al.*, 1993). Nutritionally, it is an excellent source of protein (24 %), complex carbohydrates, fibers, vitamins A and B and potassium and iron that regulates human growth and development (Anonymous, 2007). Millions of poor people in the developing countries suffer from chronic-protein deficiency. For these people in general and the vegetarian population in particular, lentil constitutes an important source of protein.

Limitation in the availability of resources makes the breeder to reduce the amount of material to be handled in segregating generations. Within the limitations, the breeder has to forward the segregating generations without losing the best recombinant lines for the traits under the improvement. The early generation selection is the best answer to this problem. Further, the concept of early generation selection gets strength from Shebeski (1967) view. According to him, the most desirable gene combinations can be identified even in the heterozygote. The essential point of this view is that the proportion of plants with the most desirable combinations of genes decreases rapidly with advancing generations, and if these are not selected in the earliest possible generation, even if heterozygous, they will be lost (Whan *et al.*, 1982). In the present study, an effort was made to know the effectiveness of early generation testing in lentil.

MATERIALS AND METHODS

Forty F_2 single plant progenies of a cross viz., L-830 \times MC-6 were the basic material for the present study. The progenies were the products of selection (with 5% intensity) based on four selection criteria such as secondary branches per plant, number of pods per plant, seed yield per plant (g) and seed index (g). The F_2 population size was 200. Bulk seed was prepared by mixing equal quantity of seeds from all F_2 plants. All the single plant progenies, along with parents and F_2 bulked seeds were raised in a randomized block design (RBD) with two replications. Each treatment was grown in a row plot of 2 m long, with 30 cm \times 10 cm spacing. Recommended agronomic package of practices was followed to raise a good crop. Observations were recorded on five randomly sampled plants in each of the selected F_3 families in each replication for plant height (cm), number of primary branches per plant, number of secondary branches per plant, number of pods per plant, seed index (g) and seed yield per plant (g). Calculation of various selection parameters in the study were estimated as per the procedure outlined by Sharma (1998).

RESULTS AND DISCUSSION

Results for selection response in F_3 families of L-830 \times MC-6 varied across selection criteria used. The results of selection response are presented in Table 1 to 4. Highest realized selection response in F_3 rR (%) was recorded for pods per plant (37.42 %), followed by secondary branches per plant (28.5 %) and yield per plant (26.59 %). The realized

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Table 1: Selection parameters for observed characters in F_3 families of L-830 \times MC-6 using secondary branches per plant.

Character	rR	rR (%)	rCRy	rCRy(%)	rh ² n (%)	rgR	pR	pR (%)	pGR	pCRy	ph ² n (%)	pS
Plant height (cm)	-	-	0.22	0.78	-	-	0.08	0.30	0.02	0.135	2	3.61
Primary branches per plant	-	-	0.33	15.49	-	-	0.13	6.01	0.33	0.070	42	0.30
Secondary branches per plant	0.93*	28.50	-	-	86	1.76	0.36	11.06	0.68	0.011	85	0.42
Pods per plant	-	-	9.26**	37.55	-	-	3.59	14.58	0.56	0.139	70	5.12
Seed yield per plant (g)	-	-	0.2	18.63	-	-	0.07	7.23	0.14	-	18	0.42
Seed index (g)	-	-	-0.48	-21.044	-	-	-0.18	-8.17	-0.22	0.226	-28	0.66

*, ** Significant at 5 and 1 % levels, respectively.

Here,

rR – Realized selection response in F_3

rCRy (%) – Percentage of realized response in

pR - Predicted response to selection in F_4

pCRy – Predicted correlated response in F_4

rR (%) - Realized selection response in F_3

F_3 rh²n (%) – Realized heritability in F_3

Pr (%) - Predicted response to selection in F_4

ph²n (%) - Predicted heritability in F_4

rCRy - Realized correlated response in F_3

rgR - Realized generalized response in F_3

pS - Predicted selection differential in F_4

pGR - Predicted generalized response in F_4

Table 2: Selection parameters for observed characters in F_3 families of L-830 \times MC-6 using pods per plant.

Character	rR	rR (%)	rCRy	rCRy(%)	rh ² n (%)	rgR	pR	pR (%)	pGR	pCRy	ph ² n (%)	pS
Plant height (cm)	-	-	-0.02	-0.079	-	-	-0.01	-0.03	-0.002	0.182	-2	4.39
Primary branches per plant	-	-	0.28	13.46	-	-	0.10	5.22	0.24	0.138	30	0.35
Secondary branches per plant	-	-	1.09*	31.85	-	-	0.42	12.37	0.41	0.089	52	0.81
Pods per plant	9.21*	37.42	-	-	44	0.91	3.57	14.53	0.35	0.196	44	8.04
Seed yield per plant (g)	-	-	0.26*	22.73	-	-	0.09	8.83	0.18	-	23	0.42
Seed index (g)	-	-	-0.35	-14.43	-	-	-0.13	-5.60	-0.19	0.140	-24	0.55

Here,

rR – Realized selection response in F_3

rCRy (%) – Percentage of realized response in F_3

pR - Predicted response to selection in F_4

pCRy – Predicted correlated response in F_4

rR (%) - Realized selection response in F_3

rh²n (%) – Realized heritability in F_3

Pr (%) - Predicted response to selection in F_4

ph²n (%) - Predicted heritability in F_4

rCRy - Realized correlated response in F_3

rgR - Realized generalized response in F_3

pS - Predicted selection differential in F_4

pGR - Predicted generalized response in F_4

Table 3: Selection parameters for observed characters in F_3 families of L-830 \times MC-6 using seed yield per plant.

Character	rR	rR (%)	rCRy	rCRy(%)	rh ² n (%)	rgR	pR	pR (%)	pgR	pCRy	ph ² n (%)	pS
Plant height (cm)	-	-	0.96	3.28	-	-	0.37	1.27	0.06	0.104	8	4.72
Primary branches per plant	-	-	0.32	15.09	-	-	0.12	5.86	0.26	0.056	32	0.38
Secondary branches per plant	-	-	1.09	31.85	-	-	0.42	12.37	0.41	0.01	51	0.82
Pods per plant	-	-	10.14	39.70	-	-	3.94	15.42	0.37	0.066	46	8.46
Seed yield per plant (g)	0.31	26.59	-	-	26	0.55	0.12	10.33	0.21	-	27	0.45
Seed index (g)	-	-	-0.32	-13.02	-	-	-0.12	-5.05	-0.18	0.073	-23	0.53

Here,

rR – Realized selection response in F_3 rCRy (%) – Percentage of realized response in F_3 pR – Predicted response to selection in F_4 pCRy – Predicted correlated response in F_4 rR (%) – Realized selection response in F_3 rh² n (%) – Realized heritability in F_3 Pr (%) – Predicted response to selection in F_4 ph² n (%) – Predicted heritability in F_4 rCRy – Realized correlated response in F_3 rgR – Realized generalized response in F_3 pS – Predicted selection differential in F_4 pgR – Predicted generalized response in F_4 **Table 4:** Selection parameters for observed characters in F_3 families of L-830 \times MC-6 using seed index.

Character	rR	rR (%)	rCRy	rCRy(%)	rh ² n (%)	rgR	pR	pR (%)	pgR	pCRy	ph ² n (%)	pS
Plant height (cm)	-	-	1.92	6.38	-	-	0.74	2.48	0.14	0.104	17	4.32
Primary branches per plant	-	-	0.34	15.75	-	-	0.13	6.12	0.37	0.057	47	0.27
Secondary branches per plant	-	-	1.13	32.69	-	-	0.44	12.69	0.88	0.01	110	0.40
Pods per plant	-	-	8.44*	35.39	-	-	3.27	13.74	0.29	0.066	37	8.78
Seed yield per plant (g)	-	-	0.32	27.02	-	-	0.12	10.49	0.22	-	28	0.45
Seed index (g)	-0.12	-4.78	-	-	-13	-0.28	-0.05	-1.89	-0.11	0.073	-13	0.36

Here,

rR – Realized selection response in F_3 rCRy (%) – Percentage of realized response in F_3 pR – Predicted response to selection in F_4 pCRy – Predicted correlated response in F_4 rR (%) – Realized selection response in F_3 rh² n (%) – Realized heritability in F_3 Pr (%) – Predicted response to selection in F_4 ph² n (%) – Predicted heritability in F_4 rCRy – Realized correlated response in F_3 rgR – Realized generalized response in F_3 pS – Predicted selection differential in F_4 pgR – Predicted generalized response in F_4

correlated response to selection for seed yield per plant was significant under the selection criteria number of pods per plant. Realised response in F_3 (rR) was significant for secondary branches per plant and pods per plant as selection criteria. Accordingly, secondary branches per plant and pods per plant recorded higher realized generalized response (rgR). This result indicates the effectiveness of pods per plant and secondary branches per plant as good selection criterion in F_2 generation of the cross. With the help of rgR values Om vir and Gupta (1999) reported that primary branches per plant as a good selection criterion in lentil. Simailar results were reported in chickpea (Salimath and Bhal 1985) and fenugreek (Yadav and Raje, 2008).

The realized heritabilities in F_3 (rh^2 (%)) is another parameter to indicate the relative effectiveness of component characters as selection criterion (Sharma 1998). In the present study secondary branches per plant and pods per plant recorded higher realized heritabilities further confirming their effectiveness as selection criterion. Om vir and Gupta (1999) reported higher realized heritability for primary branches per plant. Rasmusson and Cannell (1970) also estimated this parameter in barley.

By considering 50% selection intensity, different selection parameters like predicted response to selection in F_4 (pR), percentage of predicted response to selection in F_4 (pR (%)), predicted selection differential F_4 (pS), predicted heritability in F_4 (ph^2 n (%)), predicted correlated response (pCRy) and predicted generalized response in F_4 (pgR) were carried out for yield components. The results indicated good prospects of selection that can be carried out in F_3 generation families under each of the selection criterion on the basis of higher mean value with respective to all the characters under study.

In F_3 families of secondary branches per plant, pods per plant and seed yield per plant as selection criterion, high pR (in per cent) and high pgR were recorded for characters

like secondary branches per plant and pods per plant. This indicated that, further selection in F_3 generation families for these characters should bring about more useful results under the said criteria.

Considering pods per plant as selection criterion, predicted correlated response for seed yield per plant due to selection for number of pods per plant was the highest. Under selection criteria secondary branches per plant also pods per plant recorded highest predicted correlated response for seed yield per plant. Thus, under selection criteria pods per plant and secondary branches per plant, selection for number of pods per plant in F_3 generation families would be highly effective.

High predicted heritability in narrow sense was estimated for different yield components under the selection criteria of secondary branches per plant and number of pods per plant. High estimates of heritability in narrow sense were recorded for secondary branches per plant and number of pods per plant. On the basis of results obtained in the present investigation it can be concluded that early generation selection in lentil considering number of pods per plant in conjugation with the number of secondary branches are helpful in selection for higher seed yields. The results of the present investigation are in accordance to the results demonstrated by other investigators like Singh *et al* (1998), Om vir and Gupta (1999) in lentil and Yadav and Raje (2008) in fenugreek. Correlation studies in lentil (Yadav *et al.*, 2003; Anzam *et al.*, 2005, Kakde *et al.*, 2005; Karadavut, 2009 and Mondal *et al.*, 2013) also reported that pod number and number of branches as primary yield attributes and are positively and significantly correlated with seed yield.

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