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ADOPTION AND PROFITABILITY OF BARI LENTIL VARIETIES IN SOME SELECTED AREAS OF BANGLADESH

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Abstract

Lentil is an important pulse crop widely grown in Bangladesh. It ranks first among the pulses in terms of area and consumers' preference. BARI has developed many improved lentil varieties and disseminated to the farmers fields. The up-to-date information regarding adoption and financial profitability of this crop are unknown to the researchers and policymakers. Therefore, the study was conducted in Jhenaidah and Jessore districts to determine the adoption status and profitability of BARI lentil production and to examine the factors affecting the yield of BARI lentil during 2010-2011. Cobb-Douglas production function was used. The study revealed that 98% of the total lentil cultivated areas were occupied by BARI lentil varieties in the study areas. The average level of adoption of BARI Masur-3, BARI Masur-4, BARI Masur-5 and BARI Masur-6 were 49%, 47%, 1% and 1%, respectively at farm level. The cultivation of BARI lentil was profitable to the farmers since the per hectare total cost, gross return and net return of BARI lentil cultivation were Tk 52,734, Tk 80,572 and Tk 27,838, respectively. Functional analysis revealed that seed, urea, mechanical power cost and pesticides had positive effect on the yield of lentil production. Unavailability of latest BARI lentil seed, lack of technical know-how, lack of training, and diseases (root rot and stemphylium blight) were the main constraints to BARI lentil cultivation at farm level. BARI Masur-3 and BARI Masur-4 were the highly adopted varieties. The lentil production was profitable to the farmers in the study areas.

Keywords: Adoption, profitability, lentil, Bangladesh.

Introduction

Pulses are important legume crops in Bangladesh because of their importance in food, feed, and cropping systems. It contains about twice as much protein as cereals. It also contains amino acid lysine which is generally deficient in food grains (Elias *et al*., 1986). Pulses have played an important role in sustaining the productivity of soils in Bangladesh for centuries. They are generally grown without fertilizer since they can meet their nitrogen requirement by symbiotic fixation of atmospheric nitrogen in the soil (Senanayake *et al*., 1987; Zapata *et al*., 1987; Fried and Middleboe, 1977). The per capita consumption of pulse in Bangladesh is only 12 g/day, which is much lower than WHO recommendation of 45 g/day (Afzal *et al*., 1999).

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In Bangladesh, lentil placed second position among the pulses according to area and production but stand first in terms of usage (Afzal *et al*., 1999). It is the principal and popular edible crop among pulses. Lentil grain contains 25% protein, 0.7% fat, and 59% carbohydrate (Afzal *et al*., 1999). The area, production, and yield of lentil in Bangladesh were 208800 ha, 153000 tons (t), and 0.733 t/ha, respectively, in 1991-92 (BBS, 1995). After 18 years, the area, production, and yield of lentil were 70983 ha, 60537 t, and 0.853 t/ha, respectively, in 2008-09 (BBS, 2009). Thus, it is noted that area and production of lentil decreased 2.94 and 2.53 times, respectively. The area and production of lentil is declining year after year (Table 1).

It is observed in Table 1 that the annual growth rates of lentil area and production decreased significantly in all periods, while the rate of yield increased in all periods due to introduction of new and HYV of lentil. In Pakistan, growth rate trend showed a lower rate of decline for the lentil areas, but a higher rate of increase in yield during 1964-95 (Khan *et al*., 1988).

Table 1. Area, production, yield of lentil and annual growth rates lentil in Bangladesh during 1991–2008.

Year	Area (ha)	Production (t)	Yield (t/ha)
1991-92	208800	153000	0.733
1992-93	207800	163000	0.784
1993-94	207500	167600	0.808
1994-95	207200	168000	0.811
1995-96	205868	169945	0.826
1996-97	206439	170505	0.826
1997-98	205858	162775	0.791
1998-99	205577	165315	0.804
1999-00	166781	127775	0.766
2000-01	164567	125905	0.765
2001-02	157229	115205	0.733
2002-03	154123	115590	0.750
2003-04	154810	122225	0.790
2004-05	153899	111065	0.722
2005-06	134694	115370	0.857
2006-07	137613	116810	0.849
2007-08	72613	71535	0.985
2008-09	70983	60537	0.853
Growth rates:			
1991-2000	-2.27**	-2.19*	0.08
2001-2008	-11.69***	-8.34**	3.35**
1991-2008	-5.27***	-4.74**	0.53

Note: Growth rates were calculated by fitting exponential function/a semi-log model ($LnY_1 = Ln\ a + b_t$).

***, ** and * indicate significant at 1%, 5% and 10% level of probability, respectively.
Source: Various issues of BBS, 1995, 2000, and 2009.

Lentil is cultivated in different parts of the country. But it is extensively cultivated in mid-western parts of Bangladesh. The yield of local lentil variety in Bangladesh is very poor, but varied widely between farms and between locations (Sikder and Elias, 1985). The yield of lentil increased with an increase of farm size in India (Tomer *et al*., 1978). BARI has developed a good number popular varieties of lentil, which is growing in the farmers' fields. But the adoption status and the economic performance of this crop are unknown to the researchers and policymakers. Because, a limited study was done in this line. The rate of adoption and sustainability of any crop depends largely on its economic profitability. Economic viability is one of the important criteria for assessing the suitability of a new crop technology. Therefore, this study is expected to provide valuable information and may be useful to the researchers of BARI as well as the policy makers of both GO and NGOs for formulating appropriate policy for widespread cultivation of lentil in Bangladesh. With this view in mind, the study was undertaken to the following objectives:

Objectives

i. To estimate the area covered by the lentil varieties;
ii. To know the adoption status of BARI lentil varieties at farm level;
iii. To estimate the profitability of the BARI lentil;
iv. To examine the factors affecting the yield of lentil; and
v. To find out the constraints to BARI lentil cultivation.

Materials and Method

***Sampling design*:** A multi-stages sampling procedure was followed to select study areas and sample households. At first, two lentil growing Upazillas, namely Kaliganj from Jhenaidah and Chaugachha from Jessore district were purposively selected for the study. Secondly, two villages, namely Perojpur and Jagodispur were purposively selected from Kaliganj and Chaugachha upazilla, respectively, for household survey. Finally, a list of lentil growers was constructed for each village and then a total of 120 samples taking 60 samples from each village list were randomly selected for data collection.

***Data collection procedure*:** Data for the present study were collected by interviewing sample lentil growers using a pre-tested interview schedule during the period from March to May 2011. Secondary data were also collected from Directorate of Agricultural Extension to supplement the study.

***Analytical techniques*:** The collected data were analyzed by tabular and statistical methods. The profitability of lentil cultivation was examined on the basis of gross margin, net return, and rate of return over cost. BARI lentil varieties cultivated by farmers were classified into four categories for

determining the adoption level of technologies in terms of agronomic practices, time of operation, and input use. The categories were developed based on the mean index of the farmers with respect to each technology. A higher index indicates a higher level of adoption, while a lower index indicates a lower level of adoption of a technology. Technology adoption level was categorized for mean index > 100 as over use; (70-100) as high; (50-69) as medium and <50 as low (Miah and Alam, 2008). Adoption index was determined by the following formula.

$$\text{Adoption index} = \frac{\text{Farmers' practice}}{\text{Recommendation}} \times 100$$

Cobb-Douglas production function was used to estimate the contribution of factors influencing the productivity of lentil. The functional form of the Cobb-Douglas model is given below:

$$Y = AX_1^{b1} X_2^{b2} \ldots\ldots\ldots X_n^{bn} e^{ui}$$

The production function was converted to logarithmic form so that it could be solved by least square method i.e,

$$\text{Log } Y = \text{Log } a + b_1 \log X_1 + \ldots + b_n \log_n + U_i$$

The empirical production function was as follows:

$$\text{Ln}Y = a + {}_1\ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + b_8 \ln X_8 + U_i$$

Where,

Y = Yield (kg/ha)	X_6 = MoP (kg/ha)
X_1 = Human labour (man-days/ha)	X_7 = Gypsum (kg/ha)
X_2 = Mechanical power cost (Tk./ha)	X_8 = Pesticides (Tk./ha)
X_3 = Seed (kg/ha)	a = Intercept
X_4 = Urea (kg/ha)	b_1, b_2, ... b_n = Coefficients of the respective variables to be estimated.
X_5 = TSP (kg/ha)	Ui = Error term

Results and Discussion

Farm size of the sample farmers

The average farm size of the sample farmers was 1.72 ha in the study areas. The farm size of Kaliganj farmers was higher (2.08 ha) compared to Chaugachha farmers (1.36 ha). The average lentil cultivated area was found to be 0.51 ha in which about one hundred percent area was occupied by BARI lentil varieties. That is why, the lentil cultivated area and BARI lentil varieties areas were found to be same and it was 0.80 ha at Kaliganj and 0.21 ha at Chaugachha (Table 2).

Table 2. Farm size of lentil farmers in the study areas.

Particulars	Kaliganj	Chaugachha	All area
Farm size (ha)	2.08	1.36	1.72
Lentil cultivated area (ha)	0.80	0.22	0.51
BARI lentil varieties cultivated area (ha)	0.80	0.21	0.51

Source: Field Survey, 2011.

Area coverage by BARI lentil varieties at district level

Department of Agriculture Extension (DAE) reported that 8875 ha of land was cultivated with lentil in Jhenaidah district in 2009-2010 in which 80% areas were covered by BARI lentil varieties and 20% by local variety. In Jessore area, 9340 ha of land was devoted to lentil cultivation in which 76% areas were sown by BARI lentil varieties and 24% by local variety. On an average, 78% areas were occupied by BARI lentil varieties in the study areas (Table 3).

The level of adoption of BARI Masur-2, BARI Masur-3, BARI Masur-4, BARI Masur-5, and BARI Masur-6 were 8%, 20%, 38%, 31%, and 3%, respectively (Table 4). In Jhenaidah, BARI Masur-4 covered the highest areas (45%) followed by BARI Masur-5 (38%), BARI Masur-3 (10%), BARI Masur-2 (5%), and BARI Masur-6 (2%). In Jessore, BARI Masur-4 and BARI Masur-3 covered the same area (30%) and it was followed by BARI Masur-5 (25%), BARI Masur-2 (10%) and BARI Masur-6 (5%).

Table 3. Area under BARI lentil varieties cultivation during 2009-2010.

Study area	Total Lentil area (ha)	Area under BARI lentil varieties (ha)	Area under local variety (ha)
Jhenaidah	8875 (100)	7100 (80)	1775 (20)
Jessore	9340 (100)	7098 (76)	2242 (24)
Both areas	18215 (100)	14198 (78)	4017 (22)

Source: DAE, 2010

Table 4. Adoption scenario of BARI lentil varieties.

Study area	BARI Masur-2 (%)	BARI Masur-3 (%)	BARI Masur-4 (%)	BARI Masur-5 (%)	BARI Masur-6 (%)	Total (%)
Jhenaidah	05	10	45	38	02	100
Jessore	10	30	30	25	05	100
All Areas	08	20	38	31	03	100

Source: DAE, 2010

Area coverage by BARI lentil varieties at farm level

One hundred percent lentil cultivated areas of the sample farmers were occupied by BARI released different lentil varieties at Kaliganj area, whereas 95% areas were sown by BARI lentil varieties at Chaugachha area (Table 5). On an average, 98% lentil cultivated areas were sown by BARI released different lentil varieties in all areas and the rest areas were used by local variety. It is evident that BARI Masur-3 and BARI Masur-4 were the highly adopted varieties in the study areas.

Table 5. Distribution of lentil cultivated areas by BARI released lentil varieties.

Study areas	Lentil cultivated areas (ha)	Percent of lentil cultivated area				
		BARI Masur-3	BARI Masur-4	BARI Masur-5	BARI Masur-6	Local variety
Kaliganj	0.80	6	90	2	2	0
Chaugachha	0.22	92	3	0	0	5
All Areas	0.51	49	47	1	1	2

Source: Field Survey, 2011.

Technology used and their level of adoption

Appropriate inputs use and time of operations are essential for achieving higher yield and economic benefit. Therefore, it is important to know the existing level of technology in terms of agronomic practices, time of operation, and input use. The existing level of technology employed in the production of BARI lentil and their level of adoption have been presented in Table 6.

Farmers in the study areas ploughed their lentil lands with the help of power tiller and tractor. The number of ploughings and ladderings varied from farm to farm and location to location. On an average, 70% farmers ploughed their land 3-4 times, which is the recommended for lentil cultivation. Based on the mean index, land preparation secured the over use level of adoption. About 91% farmers applied laddering 2-3 times, which was lower than recommendation. Laddering secured medium level of adoption.

Farmers in the study areas followed broadcast method for lentil seed sowing. It was started from the third week of October and continued up to the 1st week of December. About 50% farmer's sowed seeds during last week of October to first week of November which is optimum time for seed sowing. Whereas 47% farmers sowed during second week of November to 1st week of December. At Kaliganj, 93% farmers sowed seed in optimum time but only 6% Chaugachha farmers followed it. The time of seed sowing was highly adopted at Kaliganj because farmers found it convenient to sow during the available range of time.

The recommended seed rate of BARI lentil ranged 35-40 kg/ha. All respondent farmers used higher amount of seed (30% higher) than its recommendation. Therefore, the level of adoption of seed rate was found to be over used.

Weeding was done by human labour. Fifty percent of the total farmers performed weeding once between 20 and 30 days after emergence (DAE) of seed. At Kaliganj, all farmers weeded their land one time, while Chaugachha farmers did not remove weed. The higher level of adoption was occurred in providing weeding to HYV lentil crop at Kaliganj. The study found that farmers often do not follow recommendations for applying fertilizers. They tended to either use fertilizers in excess or in very small quantities. All the sample farmers applied urea, TSP, and MoP in higher quantity compared to their recommended doses. Therefore, according to adoption index, the level of adoption for applying fertilizer is over use.

Table 6. Adoption of crop management technologies for BARI lentil production at farm level.

Technology	Recomm-endation	Kaliganj	Chaugachha	All areas	Adoption level
1. No. of ploughing (% of respondents)					Over use
3-4	Optimum	67	72	70	
5-6		33	28	30	
Adoption index		110	108	109	
2. Laddering (% of respondents)					Medium
2-3		87	94	91	
4-5	Optimum	13	06	09	
Adoption index		55	46	51	
3. Sowing time (% of respondents)					High
Third week of October		07		03	
Last week of October – First week of November	Optimum	93	06	50	
2nd week of November – 1st week of December		-	94	47	
Adoption index		97	53	75	

Table 6. Cont'd.

Technology	Recommendation	Kaliganj	Chaugachha	All areas	Adoption level
4. Seed rate (kg/ha)	35-40	48	55	52	Over use
Adoption index		121	137	129	
5. No. of weeding (% of respondent)					Medium
One time (20-30 days after germination)	Optimum	100	0	50	
Adoption index		100	0	50	
6. Fertilizer dose (kg/ha)					
Urea	45	63	60	62	Over use
Adoption index		139	133	136	
TSP	85	124	77	101	Over use
Adoption index		146	91	119	
MoP	35	69	23	46	Over use
Adoption index		198	67	133	
Gypsum		37	0	37	

Note: Adoption level was categorized for mean index > 100 as Over use; (70-100) as High; (50-69) as medium and <50 as low.

Source: Field Survey, 2011.

Input use pattern of BARI lentil cultivation

Human labour was measured in terms of man-day, which usually consisted of 8 hours. It was employed for land preparation, fertilizing, weeding, pesticiding, harvesting, threshing, and drying. The total number of human labour used for lentil cultivation was 94 man-days/ha (Table 7). The farmers of Kaliganj area used more human labour (110 mandays/ha) compared to the farmers of Chaugachha area (77 mandays/ha) due to more labour use in weeding and spraying pesticides. They used lentil seeds at the rate of 52 kg/ha. Chaugachha farmers used more quantity of seed (55 kg/ha) compared to Kaliganj farmers (48 kg/ha), which was higher than recommendation. The application of urea, TSP, MoP, and gypsum per hectare were 62 kg, 101 kg, 46 kg, and 19 kg, respectively, in all study areas which were also higher than recommendation except gypsum. It is evident that all inputs used at Kaliganj area were higher than that of Chaugachha area.

Profitability level of BARI lentil cultivation

The cost of cultivation was calculated on the basis of total variable cost and total cost. The average cost of BARI lentil production was estimated at Tk. 52734/ha and Tk. 33191/ha, respectively, on the basis of total cost and total variable cost (Table 7). The cost of lentil production at Kaliganj area was higher than that of

Chaugachha area due to more cost spent by Kaliganj farmers almost in all items except seed and land use. It is evident from Table 8 that the average grain yield of BARI lentil varieties was 1733 kg/ha in all areas. The grain yield was higher at Kaliganj (1871 kg/ha) compared to Chaugachha (1595 kg/ha) due to higher input use. On an average, gross return was found to be Tk. 80572/ha in all study areas. Table 8 revealed that gross return at Kaliganj was higher (Tk. 85958/ha) than that of Chaugachha (Tk. 75186/ha). The average gross margin of BARI lentil was estimated at Tk. 47381/ha in all areas. Gross margin at Chaugachha was higher than that of Kaliganj. The net return of BARI lentil was calculated Tk. 27838/ha in all areas. The net return at Kaliganj was higher than that of Chaugachha. Benefit cost ratio was found to be 1.53 on total cost basis in all areas. BCR at Chaugachha was higher than that of Kaliganj.

Table 7. Input use pattern and cost of BARI lentil production at farm level.

Cost Items	Kaliganj		Chaugachha		All Areas	
	Quantity	(Tk./ha)	Quantity	(Tk./ha)	Quantity	(Tk./ha)
Labour (manday/ha)	110	16526	77	11477	94	14002
Mechanical power cost (Tk/ha)	6356	9913	6055	7758	6206	8836
Seed (kg/ha)	48	4197	55	4300	52	4249
Fertilizers:	-	4735	-	2764	-	3749
Urea (kg/ha)	63	751	60	711	62	731
TSP (kg/ha)	124	2752	77	1658	101	2205
MoP (kg/ha)	69	1041	23	349	46	695
Gypsum (kg/ha)	37	190	-	-	19	95
Insecticides (Tk/ha)	4711	4711	-	-	2356	2355
Intt. on operating capital	-	401	-	263	-	332
Land use cost	-	17028	-	21394	-	19211
Total variable cost	-	40082	-	26299	-	33191
Total cost	-	57511	-	47956	-	52734

Source: Field Survey, 2011.

Table 8. Productivity and profitability of BARI lentil production at farm level.

Items	Kaliganj	Chaugachha	All Areas
Yield (kg/ha)	1871	1595	1733
Gross return (Tk./ha)	85958	75186	80572
Total variable cost (Tk./ha)	40082	26299	33191
Total cost (Tk./ha)	57511	47956	52734
Gross margin (Tk/ha)	45876	48886	47381
Net return (Tk./ha)	28447	27229	27838
Benefit cost ratio (undiscounted)	1.49	1.57	1.53

Source: Field Survey, 2011.

Input output relationship

In order to determine the contribution of independent variables in lentil production, Cobb-Douglas production function was used. Before going to analyze data, multi-collinearity among the variables was checked and found no multi-collinearity in the data. Table 9 shows that the coefficients of seed, urea and pesticides were positive and significant at 1% level, which indicated that 1% increases in those inputs keeping other factors remaining constant would increase the yield by 0.223%, 0.141% and 0.021%, respectively. It implied that seed, urea and pesticides had positive effect on the yield of lentil production. The coefficient of mechanical power cost was positive and significant at 10% level indicating that 1% increases in the use of mechanical power cost, keeping other factors remaining constant would increase the yield by 0.102%. The coefficient of gypsum was negative and significant at 5% level, which indicated that 1% increases of gypsum, keeping other factors remaining constant would decrease the yield by 0.025%. The returns to scale of lentil production were the summation of regression coefficients of all inputs in this study. It is noted from Table 9 that the returns to scale of lentil was 0.48. This implied that production function exhibited decreasing return to scale and lied on the second stage of production. This also implied that if all inputs specified in the production function were increased simultaneously by 100%, the yield would increase by 48%.

Table 9. Estimated coefficients and related statistics of Cobb-Douglas production function for BARI lentil production.

Explanatory variables	Coefficients	Standard error	t-values
Constant	4.970***	0.524	9.489
Human labour	- 0.016	0.061	- 0.269
Mechanical power cost	0.102*	0.057	1.784
Seed	0.223***	0.075	3.104
Urea	0.141***	0.033	4.274
TSP	0.023	0.016	1.432
MoP	0.011	0.008	1.363
Gypsum	- 0.025**	0.009	- 2.767
Pesticides	0.021***	0.004	4.987
Returns to scale (RTS)	0.48		
R^2	0.80		
F-value	14.613***		

Note: ***, ** and * indicate significant at 1%, 5% and 10% level, respectively.

Farmer's opinions towards BARI lentil production

Farmers were very much pleased to cultivate modern varieties of lentil because these varieties were high yielder, profitable, and easy to produce. It was lesser infested by insect pest and lesser attacked by disease compared to local variety of lentil (Table 10).

Table 10. Farmers' opinions regarding BARI lentil production.

Opinion	Percent of responses		
	Kaliganj	Chaugachha	All area
1. High yielder	100	100	100
2. Profitable crop	100	100	100
3. Easy to produce	90	86	88
4. Lesser pest infestation and disease attack	60	70	65

Source: Field Survey, 2011.

Constraints to BARI lentil production at farm level

The farmers in the study areas encountered some constraints to BARI lentil production. The first ranked constraint was unavailability of latest BARI lentil varieties' seeds in all areas. It is followed by unknown about latest BARI lentil varieties, lack of technical know-how, and lack of training, attack of diseases (root rot, leaf spot and stemphylium blight), high price of pesticides, slightly low price, and less taste compared to local variety lentil (Table 11).

Table 11. Constraint to BARI lentil production at farm level.

Constraints	Rank value		
	Kaliganj	Chaugachha	All Areas
1. Unavailability of latest BARI lentil varieties seed	1	1	1
2. Unknown about latest BARI lentil varieties	2	2	2
3. Lack of technical know-how	3	3	3
4. Lack of training	4	4	4
5. Attack of diseases	5	5	5
6. High price of pesticides	6	6	6
7. Lower price and less taste compared to local lentil variety	7	7	7

Source: Field Survey, 2011.

Facilities needed for increasing BARI lentil production

Lentil farmers in the study areas encountered some constraints to BARI lentil production. They used improved seeds of different lentil verities which were developed by BARI and disseminated for farm level use for some years back. In the mean time, six improved lentil varieties have already been released for farmers' use. But these latest varieties are not available to them. Therefore, all the respondent farmers demanded for making those latest lentil varieties available to their nearest local seed market (Table 12). Technical know-how about the improved production technology is very much important for efficient use of inputs and receiving higher yield. Most respondent lentil farmers did not get expected yield due to apply traditional knowledge in producing lentil. Therefore, they need hand-on training on lentil production. Biotic stress is another important constraint to lentil cultivation for which they can't harvest good yield. They opined that some of their used varieties were susceptible to disease. This problem was reported in Kaliganj higher than that of Chaugachha. Hence, most of the respondent farmers suggested developing disease resistant variety for them.

Table 12. Facilities demanded by farmers regarding BARI lentil cultivation.

Type of facility	Percent of responses		
	Kaliganj	Chaugachha	All area
1. Availability of latest BARI lentil varieties seed	100	100	100
2. Providing training about lentil production	100	100	100
3. Development of disease resistant lentil variety	96	90	93

Source: Field Survey, 2011.

Conclusion and Recommendations

Based on the findings of the study, it may be concluded that the highly adopted varieties were BARI Masur-3 and BARI Masur-4. About 98% lands were occupied by BARI lentil varieties. BARI has developed some new varieties which are better in all respect to them. So, popularization of BARI Masur-5 and BARI Masur-6 is needed and farmers should be motivated accordingly.

Majority of the farmers did not get desired yield for ignoring the recommended use of inputs. So, formal and hand-on training and demonstration on modern method of producing BARI lentil should be imparted to the farmers.

The gross margin and net return of BARI lentil cultivation were positive and encouraging to the farmers. This message should be circulated among the growers through various media.

The influence of seed, urea, mechanical power cost, and pesticides in lentil production were positively significant. Inadequate use of inputs impedes the effectiveness of other inputs which causes low yield. So, farmers must learn proper use of inputs in time. They should follow recommended practices accurately.

Lentil farmers could not receive higher benefit from lentil cultivation due to various constraints. These constraints were unavailability of latest BARI lentil variety seed, unknown about latest BARI lentil varieties, lack of technical know-how, lack of training and attack of diseases. Therefore, necessary steps should be taken to make disease resistant BARI lentil seed available to the farmers. Nonetheless, lentil farmers should also be provided hand-on training on package technology of lentil cultivation.

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