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Performance of BARI released lentil varieties in charland ecosystem under Kurigram district

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ABSTRACT

The on-farm trial of BARI released lentil varieties was conducted at the MLT site, Ulipur, Kurigram during Rabi season of 2013-14 and 2014-15 in the Lentil-Sesame-Fallow cropping pattern in the Charland. The experiment was laid out in a randomized complete block design with six dispersed replications. Four variety viz., BARI Masur-4, BARI Masur-5, BARI Masur-6 and BARI Masur-7 with local cultivar were compared for this purpose. Among the tested varieties, BARI Masur-7 gave the highest yield in both year (1.43 and 1.40 t/ha) which differed significantly from other varieties and the lowest yield was recorded from local (0.860 and 0.834 t/ha). The highest gross return (Tk. 114240 and 112000 ha⁻¹) and gross margin (Tk. 81940 and 77160 ha⁻¹) were obtained from BARI Masur-7 in two consecutive Rabi season. The lowest gross return (Tk. 68800 and 66720 ha⁻¹) and gross margin (Tk. 36500 and 31880 ha⁻¹) were obtained from the local cultivar. The lentil production was profitable to the farmers in the study areas with BARI released lentil varieties.

Key Words: Charland, Lentil, Adoption, Profitability and Bangladesh

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I. Introduction

Among the pulse crop Lentil (*Lens culinaris* L. Medik) ranked first among pulse crop in Bangladesh belongs to family Fabaceae, covering an area of 162 thousands hectares of land with an annual production of 211 thousands metric tons and the average yield of lentil is 0.80 ton ha⁻¹ (BBS, 2012). It occupies second position after mungbean in respect of area and production. Greater Faridpur, Jessore, Khustia, Pabna, and Rajshahi are the major lentil growing area in the country. In Bangladesh, lentil ranks first position in market price. Its seeds contain 59.8% CHO, 25.5% protein, 10% moisture, 4% mineral and 3% vitamins (Khan, 1981; Gowda, 1982). The green plants can also be used as animal feed and its residues have soil manurial value (Gahoonia et al., 2004). The acreage and production of lentil are steadily declining in our country (BBS, 2012) (Figure 01). However, the average yield of lentil is about 929 kg ha⁻¹ which is very low compared to lentil growing countries of the world (BBS, 2012). There are so many reasons for lower yield of lentil. The HYVs and management of nitrogen fertilizer

are the important ones that greatly affects the growth, development and yield of this crop. In crop production systems, screening and introducing adaptable crop varieties for char land ecosystem would be needed to address under changing climatic condition. Charland area may be defined such type of land that emerge like island within or near river stream by result of erosion and deposition of sands (Sattar and Islam, 2010). In Bangladesh, Char land areas are estimated to be 0.72 million ha which contribute 5% of the country area (EGIS, 2000). Most of them are cultivable (Ahmed et al., 1987). In bangladesh char land areas normally remain fallow. In recent years char land areas turn into major cash crop growing area like hybrid maize, sweet potato, lentil, mustard, grasspea, field pea, sweet gourd, sugarcane etc. Generally all of the crops are grown with low management practices which in high effort giving less output (Islam et al., 2012). Introduction of new crops with modern varieties (MV) along with proper insect-pest management will boost up crop production ultimately result poverty reduction of the low income generating marginal farmers. Economic development of the farmers will help in livelihood development. Climate change issue is now major concern regarding crop productivity in Bangladesh. Lentil-Sesame-Fallow Cropping pattern is one of the major cropping pattern practiced by the farmers in char land of Kurigram district (Ulipur, Chilmari, Rawmari, Rajibpur upazila). Lentil is the most important pulse crop of the farmer in this area. However, farmers are cultivating local varieties of lentil which is poor yielder. In recent years pulse area and production in decreasing trend (Figure 01). Pulse Research Centre of BARI has developed some high yielding varieties of lentil. Inclusion of these varieties in this cropping pattern replacing local by developed variety may increase the yield and profitability of the farmers, again, performances of these varieties need to be evaluated under char land situation. A study was, therefore, undertaken with the objective to evaluate the feasibility and popularize of latest BARI released lentil varieties over the local.

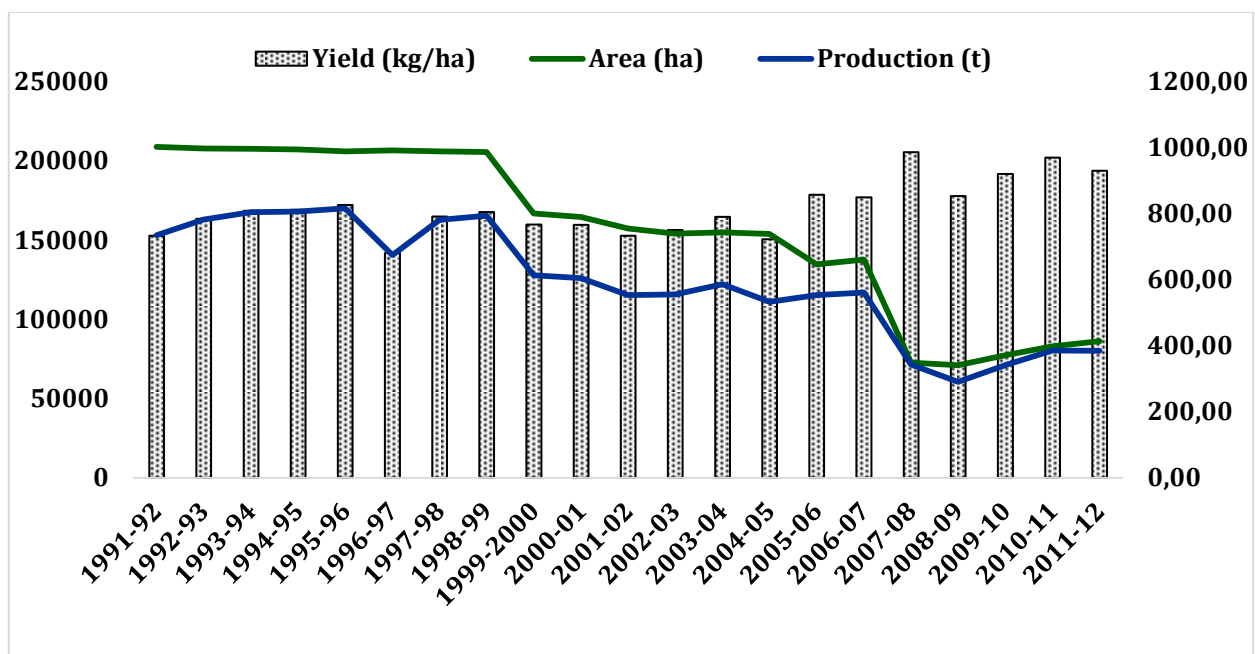


Figure 01. Area, production, yield of lentil and annual growth rates during 1991–2012.

II. Materials and Methods

An on-farm trial was set up at Multi Location Testing (MLT) Site under BARI, Rangpur at Ulipur, Kurigram during Rabi season of 2013-14 and 2014-15. It belongs to the Testa Meander Floodplain Agro-ecological Zone of Bangladesh (AEZ-3). The experimental site dominant with tropical monsoon climate with irregular rainfall. The most of the rainfall was received during the months of May to September. The annual rainfall of the study period were 862 mm and 512mm. Mean annual minimum and maximum temperature was 23.47/32.46°C and 20.55/29.95°C, respectively. Soil samples from experimental area were collected from 0-20 cm depth prior to set up experiments and analyzed in the laboratory. Results of soil analysis are presented in Table 01. The soil was sandy loam with medium organic matter content (1.83%) and soil pH ranged from 5.7 to 5.8 slightly alkaline in nature. The statuses of N, K, P, S, Zn and B were very low, Medium low, Medium low, very low, medium and low,

respectively (Table 01). The experiment was laid out in randomized complete block design with six dispersed replications. The unit plot size was 12m × 10m.

Table 01. Soil nutrient status of the experimental area (AEZ-3) of Kurigram, during 2012-14

Parameters	OM (%)	pH	Total N (%)	K (meq/100 g of soil)	P	S	Zn	B
					(µg/g soil)			
Range	1.72-1.94	5.7-5.8	0.09-0.10	0.10-0.17	7.1-10.88	7.20-9.17	1.06-1.13	0.22-0.29
Average	1.83	5.75	0.01	0.14	8.98	8.19	1.1	0.26
Critical limit	-	-	0.12	0.12	10.00	10.00	0.6	0.2
Interpretation	Medium	Slightly alkaline	Very low	Medium low	Medium low	Very low	Medium	Low

Four high yielding lentil varieties viz. BARI Masur-4, BARI Masur-5, BARI Masur-6 and BARI Masur-7 with local available cultivar were tested for their adaptability in charland eco-system. The crop received total rainfall of 13 mm during growing period. The average maximum and minimum air temperatures during crop period were 26.9°C and 14.1°C, respectively. The initial soil moisture content at the time of sowing was 20-22% by weight. Seeds of lentil were sown 30 cm apart in solid line on 14-17 November, 2013 and 12-16 November 2014. Fertilizers @ 20-36-25 kg/ha of NPK (FRG, 2012) were applied at the time of final land preparation in the form of urea, triple super phosphate and Muriate of potash. One hand weeding was done at 25 days after sowing (DAS). The crop was harvested on 05-08 March, 2014 and 03-07 March, 2015. Data on yield and yield contributing characters were taken and statistically analyzed following MSTAT-C software package.

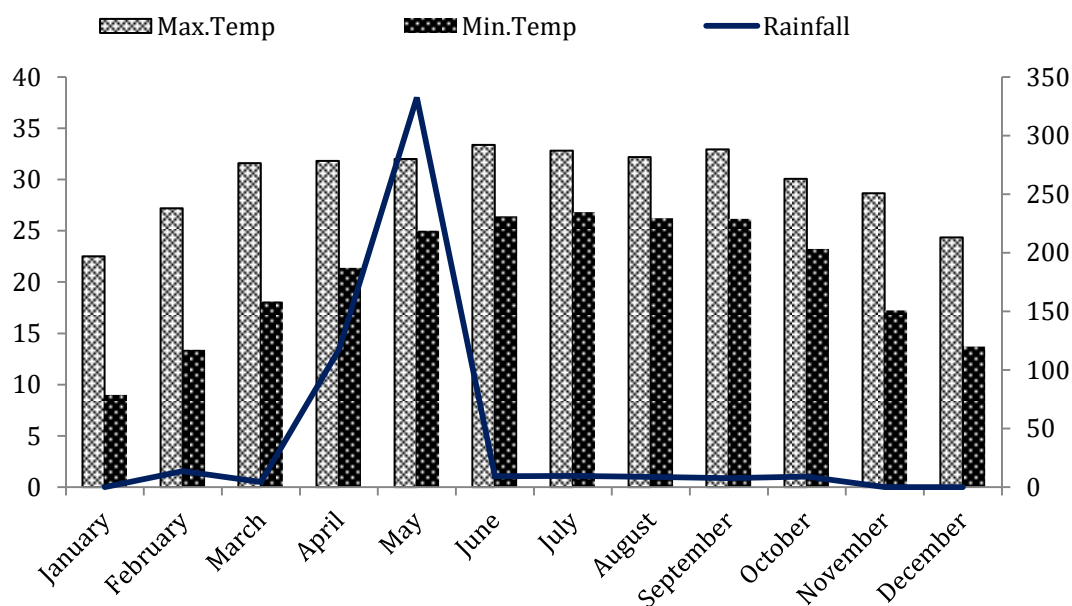


Figure 02. Monthly average maximum temperature, minimum temperature and rainfall during the cropping period from 2013-15 in Ulipur, Kurigram

III. Results and Discussion

Effect on days to maturity: The total crop duration to attain physiological maturity of a crop indices maturity days Four BARI Masur varies regarding maturity day in both the cropping season. Total crop duration was varied from 106-121 days and there was statistical significant difference among the varieties. In 2013-14 longest crop duration was recorded in BARI Masur-7 (121 days) and local

cultivar attain maturity within shortest period (106 days). However, BARI developed lentil varieties required 6-13 days more than local variety. Mamun (2006) and Karim (2006) were also found different days to maturity in lentil.

Effect on plant height: The variation in plant height was found significant due to the genotypic characters of the lentil varieties. In both year there was no statistical difference among the varieties regarding plant height. Numerically tallest plant was found in BARI Masur-7 (30.82cm and 31.85cm) and shortest plant was found in Local cultivar (25.68 cm and 26.22 cm) respectively in 2013-14 and 2014-15. The results of the present study were also supported by Talukder (2004) and Maola (2005).

Effect on plant m⁻²: A significant variation ($p \geq 0.01$) was observed among the varieties with regards to their number of plant per m⁻² at harvest (Table 02 and 03). Plant population was counted from quadrat of 1m². It was found that the maximum (168 and 169) number of plants m⁻² was found in local and lowest was found in BARI Masur-5 (127 and 129) respectively in both year.

Effect on pods plant⁻¹: The main effect of variety on total number of pods per plant was significant (Table 02 & 03). The highest number of pods per plant (68.13 & 66.36) was recorded from the variety BARI Masur-7 which was at par with BARI Masur-6 (66.30) and BARI Masur-5(64.10) during 2013-14 but followed by BARI Masur-6(64.47), BARI Masur-5 (63.93) and BARI Masur-4 (61.52) during 2014-15. The lowest number of pods/plant was observed in local variety (43.56 and 45.24).

Table 02. Seed yield and yield contributing characters of lentil varieties at charland ecosystem in Kurigram during 2013-14

Varieties	Days to maturity	Plant height (cm)	Plant/ m ² (no.)	Pods plant ⁻¹ (no.)	Seed pod ⁻¹ (no.)	1000 seed weight(g)	Seed yield(kg ha ⁻¹)	Yield increase over local (%)
BARI Masur-4	112c	29.98a	130c	62.03ab	1.67a	20.06a	1.312b	52.56
BARI Masur-5	119ab	29.57a	127c	64.10a	1.71a	19.99a	1.313b	52.67
BARI Masur-6	116bc	30.33a	132c	66.30a	1.69a	20.15a	1.422a	65.35
BARI Masur-7	121a	30.82a	152b	68.13a	1.85a	21.07a	1.428a	66.05
Local	106d	25.68a	168a	43.56b	1.34b	16.74b	0.860c	
<i>LSD value (0.05)</i>	4.87	5.81	10.70	19.64	0.2	1.21	105.2	
<i>CV (%)value</i>	2.25	10.55	4.01	17.15	6.37	3.25	4.41	

Table 3. Seed yield and yield contributing characters of lentil varieties at char land ecosystem in kurigram during 2014-15

Varieties	Days to maturity	Plant height (cm)	Plant/ m ² (no.)	Pods plant ⁻¹ (no.)	Seed pod ⁻¹ (no.)	1000 seed weight(g)	Seed yield(kg ha ⁻¹)	Yield increase over local (%)
BARI Masur-4	111cd	32.39a	129c	61.52ab	1.663a	19.91a	1.26b	
BARI Masur-5	118ab	30.38a	129c	63.93ab	1.720a	19.93a	1.27b	
BARI Masur-6	114bc	31.26a	135c	64.47ab	1.700a	19.77a	1.38a	
BARI Masur-7	120a	31.85a	153b	66.36a	1.843a	20.86a	1.40a	
Local	107d	26.22a	169a	45.24b	1.363b	16.38b	0.834c	
<i>LSD value (0.05)</i>	5.58	6.28	11.64	20.19	0.21	1.29	111.8	5.58
<i>CV (%) value</i>	2.59	10.96	4.32	17.78	6.48	3.53	4.83	2.59

Effect on seeds pod⁻¹: There was no significant difference was shown on the number of seeds per pod due to the effect of varieties. Number of seeds/pod between BARI Masur-7 (1.85) and other BARI Masur variety was statistically at par. The minimum number of seeds/pod was obtained from local

variety (1.2). Thousand seed weight i.e. seed size is a genetically controlled trait of lentil (Table 02 & 03).

Effect on 1000-seed weight: Variety had a significant influence on 1000-seed weight (Table 02 & 03). The maximum 1000-seed weight (21.07 g & 20.86 g) was found from the variety BARI Masur-7 followed (20.15 g & 19.77) by the genotype BARI Masur-6 respectively. The lowest 1000-seed weight (16.74 g & 16.38 g) was observed in local variety. Varietal differentiation in 1000-seed weight also found by [Rajat and Gowda \(1998\)](#).

Effect on seed yield: The variety had a significant influence on seed yield of lentil. The maximum seed yield was recorded in BARI Masur-7 (1428 kg/ha) due to higher pod plant⁻¹, seed pod⁻¹ with higher thousand seed weight and it was statistically similar with BARI Masur-6 (1422 kg/ha), BARI Masur-5 (1313 kg/ha) and BARI Masur-4 (1312 kg/ha) during 2013-14. Local lentil variety produced the lowest seed yield (860 kg/ha) due to lower No. of pod plant⁻¹, seed pod⁻¹ and thousand seed weight. Next year highest seed yield was recorded in BARI Masur-7 (1400 kg/ha) which was statistically at par with BARI Masur-6 (1380 kg/ha) and local gave the lowest seed yield (834 kg/ha).

Effect on yield increase over local (%): Seed yield of BARI developed lentil varieties was 52.56–66.05% higher than local lentil variety in 2013-14 and in 2014-15 it was 51.08-67.87% higher over local. The higher seed yield in BARI developed lentil varieties were attributed to higher pods/plant, seeds/pod and 1000 seed weight. Similar findings were obtained by [Islam et al. \(2010\)](#). The results revealed that high yielding variety of lentil developed by BARI performed better in char land ecosystem under climate change situation.

Cost and return data prepared based on the prevail market price. In 2013-14 highest return was recorded in BARI Masur-7 (114240 Tk. ha⁻¹) and lowest was in local cultivar (68800 Tk. ha⁻¹). In gross return similar trend was found. In 2014-15 highest net return was recorded in BARI Masur-7(77160 Tk. ha⁻¹) and lowest was found in local cultivar (31880 Tk. ha⁻¹). (Table- 04).

Table 04. Cost benefit analysis of Wheat-Jute-T. Aman rice cropping pattern under farmers' and improved practices

Year	Lentil variety	Lentil Yield (tha ⁻¹)	Gross Return (Tk. ha ⁻¹)	Cost of Cultivation (Tk. ha ⁻¹)	Gross Margin (Tk. ha ⁻¹)	BCR
2013-14	BARI Masur-4	1312	104960	32300	72660	3.25
	BARI Masur-5	1313	105040	32300	72740	3.25
	BARI Masur-6	1422	113760	32300	81460	3.52
	BARI Masur-7	1428	114240	32300	81940	3.54
	Local	860	68800	32300	36500	2.13
2014-15	BARI Masur-4	1260	100800	34840	65960	2.89
	BARI Masur-5	1270	101600	34840	66760	2.92
	BARI Masur-6	1380	110400	34840	75560	3.17
	BARI Masur-7	1400	112000	34840	77160	3.21
	Local	834	66720	34840	31880	1.92

Price (Tk. /kg): Urea=20, TSP= 25, MP= 15, Gypsum=10, Zinc = 150, Boric acid = 180 and lentil = 80/kg

IV. Conclusion

Based on the findings of the study, it may be concluded that the BARI lentil varieties can be easily grown in Charland area of kurigram. So, popularization of BARI Masur is needed and farmers should be motivated accordingly.

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