Eco-friendly Agril. J. 8(12): 116-120, 2015 (December)

PERFORMANCE OF ADVANCED LENTIL GENOTYPES IN DIFFERENT PULSE GROWING REGIONS OF BANGLADESH

MM Rahman[1] * MM Islam[1] ME Hoque[1] B Ahmed[1] and MM Rahman[2]

Address
[1]Scientific Officer, Bangladesh Agricultural Research Institute (BARI), Gazipur [2]PhD Research Fellow, Jahangirnagar University, Savar, Dhaka Bangladesh

Correspondence*
mosiur1979@yahoo.com

Accepted by 27 November, 2015

Abstract

Four lentil genotypes were collected from ICARDA (International Center for Agricultural Research in Dry Areas), Aleppo, Syria and evaluated under five locations in Bangladesh viz. Pulses Research Center, Ishurdi; Regional Agricultural Research Station, Jessore; Regional Agricultural Research Station, Jamalpur; Regional Pulse Research Station, Madaripur and Bangladesh Agricultural Research Institute, Gazipur during the year 2013-14. The lines are BLX 07003-6, BLX 07004-7, BLX 07004-2, BLX 07004-12 and BARI masur-7 as check were included in the experiment. The experiment was laid out in a completely randomized block design with three replications. Significant variation was observed for days to flowering, days to maturity, pods per plant, 1000 seed weight and yield in kg hectare^{-1}. Among the test entries, BLX 07004-2 showed the highest numbers of pods/plant followed by BLX 07004-12 while the largest seed size was recorded in BLX 07004-12.The lowest days to maturity was recorded in BLX 07004-7.The entry BLX 07003-6 showed highest plant height followed by BLX 07004-2. The lowest disease score of *stemphylium* blight was recorded in BLX 07004-12 and BARImasur-7 followed by BLX 07004-2 and BLX 07003-6. The highest disease score of *stemphylium* blight was recorded in BLX 07004-7.The entry BLX 07004-2 showed the highest yield followed by BLX 07004-12.

Key words: Lentil, Advanced genotypes, Evaluation, GGE biplots and yield.

Introduction

Lentil (*Lens culinaris* L. Medic) popularly known as *Masur*, is an important grain legume in Indian sub-continent and Mediterranean region. Bangladesh ranks third among the lentil growing countries of the world (BBS, 2009). The total pulse production in Bangladesh is 196000 metric tons from an area of 226,316 hectares (BBS, 2009). Lentil is the second most important crop in area and production among the pulse crops in Bangladesh, but stands first in consumer's preference in this country. Out of the total pulse production lentil contributes 61,000 metric tons from 70,850 hectares of land with mean yield of 0.86 t ha^{-1} (BBS, 2009). The protein content of lentil seeds varies from 21.2 to 32.5% (Purseglove, 1968; Dimitrove, 1973). It occupies a unique position in the world agriculture by virtue of its high protein content and capacity for fixing atmospheric nitrogen by *Rizobium* bacteria in root nodules. In developing countries like Bangladesh, lentil can improve the overall nutritional value of cereal based diet. Unfortunately, there is an acute shortage of lentil in relation to its demand in Bangladesh. It is considered as the poor man's meat as it is the cheapest source of protein for underprivileged people who cannot afford to buy animal protein (Gowda and Kaul, 1992).

Generally, lentil is sown as sole or mixed crop after the harvest of summer or rainy crops in Bangladesh. The suitable time for sowing of lentil in Bangladesh is from mid-October to mid-November (BBS, 2009). The average yield of lentil in Bangladesh is very low, 860 kg ha^{-1}. As a source of protein, the domestic production of lentil is far below the recommendation (BBS, 2009). Several causes are responsible for low yield of the lentil crop of which the use of traditional local cultivar, low plant density per unit area, weed infestation, appropriate time of sowing and poor crop management practices constitute the major ones. Use of high yielding varieties of lentil, and effective management may increase the lentil production per unit area substantially in Bangladesh. In this regards collection and evaluation of germplasm have wide genetic variation can lead to the development of new varieties having improved specific traits. In practice, it is a continuous process in genetic program for developing new and improved varieties. In this purpose, some advance lentil genotypes were collected from ICARDA. The present experiment was undertaken to evaluate growth, maturity, and yield performance of the collected lentil genotypes with a view to develop a new variety(s) having desirable traits.

Materials and Methods

The experiment was conducted at the research field of five locations viz.1. Pulses Research Center, Ishurdi 2. Regional Agricultural Research Station, Jessore 3. Regional Agricultural Research Station, Jamalpur, 4. Regional Pulse Research Station, Madaripur and 5. Bangladesh Agricultural Research Institute, Gazipur

during the period of 2013-14. The experimental materials comprised of four advanced lentil genotypes namely BLX 07003-6, BLX 07004-7, BLX 07004-2, and BLX 07004-12 including BARI masur-7 as check. All the genotypes were obtained from ICARDA. The experiment was laid out in the Randomized Complete Block Design (RCBD) with three replications. Each entry was sown in unit plot of 4 m X 2.4 m long with a spacing of 40 cm between rows. Spacing between two plots were 40 cm. The experimental field was prepared by repeated ploughing followed by laddering. After ploughing and laddering all the stubble and uprooted weeds were removed from the field. Before final land preparation, NPKS was applied @ 20-40-20-10 kg ha^{-1}, respectively. Seeds were sown in the rows carefully by hands at 3 cm depth and then covered by soils. Seeds were sown on 10 November to 16 November. Post sowing irrigation was given to ensure seed germination. Weeding was done to keep the plots free from weeds. Each of the entries were investigated from seedling to harvest and compared with checks. Grain yield was calculated from the whole plot. Data on yield contributing characters were taken from the 10 randomly selected plants from the middle rows of each plot. Data on different parameters such as plant height, days to flowering, days to maturity, pods $plant^{-1}$, 100 seed weight and seed yield were recorded from each plot. The collected data from the experiment were analyzed by using statistical package programme MSTAT-C to illustrate the statistical significance of the experimental results developed by Gomez and Gomez (1984). The means differences were compared by using Least Significant Difference (LSD) test at 5% level of significance. The GGE biplots is a component of genetics variance for all the characters which was done according to yield.

Results and Discussion

Plant height

In present studies the plant height remained significantly different due to various lentil genotypes in different locations (Table-1). The highest mean plant height was found in the genotype BLX-07003-6 and followed by BLX-07004-2. The lowest mean plant height was found in BLX-07004-7 and check variety BARI Lentil-7. Ayub *et al.* (2004) suggested that shorter varieties with more number of branches may be considered as selection index in lentil. The trial in Madaripur showed the shortest plant height than other location.

Days to 50% flowering

A remarkable range of variability in days to 50% flowering was observed (Table-1). The line BLX-07004-7 and check variety BARI masur-7 was found early as it completed 50% flowering within 59 days. The line BLX-07004-2 was found late with 64 days to 50% flowering. Significant genetic variability in flowering period in lentil genotypes have also been reported by Bakhsh *et al*. (1993); Bicer and Sarkar (2004).

Days to maturity

It has been observed that medium maturing lines are the most ideal for higher production in lentil. Any delay in maturity increase the cost of yield in lentil (Amanullah and Hatam, 2000; Hegazy *et al*., 2012). In our studies days to maturity were found highly significantly diversed due to various lentil genotypes. The maturity period ranged from 110 to 118 days in different location. Among the genotypes tested, the line BLX-07004-7 remained early in maturity availing 111 days (Table-2). Majority of lines belonged to medium maturity group. This may be due to the fact that early as well as late varieties are not desirable from breeding point of view and varietal behavior showed that most of the selections were made from medium type plants in lentil. These results have been endorsed by Ayub *et al.* (2004), Yaqoob *et al.* (2005) and Hegazy *et al.* (2012) who also observed highly significant diversity in days to maturity in various lentil germplasms.

Number of pods per plant

The number of pods is the most important yield contributing parameter in lentil (Table-2). The highest number of pods usually leads to higher grain yield and vice versa. In present investigations the number of pods were significantly affected due to various lentil lines. Highest number of pods per plant (97) were produced by line BLX 07004-2 followed by BLX 07004-12 and the largest seed size was recorded in BLX 07004-12. The line BLX-07003-6 produced the lowest number of pods per plant (86). There was variation among the different location. The performance of Jessor trial was best in case of number of pods per plant. Highly significant variability in number of pods in lentil germplasm have also been noted by Hegazy *et al*. (2012); Kayan and Olgun (2012); Roy *et al*. (2013).

1000 seed weight

Size and weight of seed is important trait which directly correlates with final grain yield. The selection criterion on the basis of seed size varies from crop to crop. The size of grains always differs under different soil moisture regimes and nutrient availability to crop. The genotypes showing larger seed size do not necessarily produce higher yields because of less in quantity. In present studies 1000 seed weight in various lentil genotypes was varied. The heaviest seed (22.18 g/1000 grain) was produced by line BLX-07004-2. The smaller size seed was produced by BLX-

07004-7 (Table-3). The results of Amanullah and Hatam (2000) revealed that size of the grain is positively associated with grain yield in lentil, while Chakraborty and Haque (2000) reported a negative impact of seed size on grain yield in lentil. The contradiction in findings might be due to use of diversified genotypes and climatic variations.

Stemphylium blight Disease

There was a significant variation among the genotypes regarding *stemphylium* blight Disease. The lowest disease score of *stemphylium* blight was recorded in BLX 07004-12 and BARImasur-7 followed by BLX 07004-2 and BLX 07003-6. The highest disease score of *stemphylium* blight was recorded in BLX 07004-7. The disease was highest in Madaripur and Jessor district due to favorable climatic condition (Table-3).

Table 1. Mean performances of five lentil genotypes for plant height and Days to flowering at different locations

Sl. No	Entries	Plant height (cm)						Days to 50 % flowering					
		Ish	Joy	Mad	Jes	Jam	Mean	Ish	Joy	Mad	Jes	Jam	Mean
1	BLX-07003-6	33	32	27.09	40	30.5	33	63	64	55	61	56	60
2	BLX-07004-7	33	32	22.70	38	29.4	31	61	63	54	62	56	59
3	BLX-07004-2	33	32	26.76	40	31.3	33	71	69	53	65	63	64
4	BLX-07004-12	32	36	25.06	38	30.6	32	70	68	54	63	57	62
5	BARI masur-7	31	31	23.86	40	31.4	31	62	62	54	62	57	59
	CV (%)	11	3.4	7.91	5.7	6.93	-	1.4	1.3	-	0.77	2.8	-
	LSD (0.05)	6.6	6.1	3.74	NS	NS	-	1.7	1.8	NS	1.01	2.6	-

Ish= Ishurdi, Joy= Joydebpur, Mad= Madaripur, Jes= Jessor and Jam= Jamalpur

Table 2. Mean performances of five lentil genotypes for Days to maturity and Pods plant^{-1} at different locations

Sl. No	Entries	Days to maturity						Pods/plant					
		Ish	Joy	Mad	Jes	Jam	Mean	Ish	Joy	Mad	Jes	Jam	Mean
1	BLX-07003-6	115	114	114	110	110	113	59	60	32.47	207	71.9	86
2	BLX-07004-7	112	112	112	111	110	111	70	68	43.93	190	74.1	89
3	BLX-07004-2	118	116	112	112	113	114	93	82	44.40	177	86.5	97
4	BLX-07004-12	116	115	112	112	111	113	84	83	40.73	183	83.9	95
5	BARI masur-7	116	115	111	112	111	113	75	73	45.40	194	82.8	94
	CV (%)	0.85	0.82	-	-	2.3	--	14.5	14.1	4.99	12.78	5.63	-
	LSD (0.05)	1.86	1.77	-	NS	4.5		20.8	19.9	3.89	2.05	3.75	-

Ish= Ishurdi, Joy= Joydebpur, Mad= Madaripur, Jes= Jessor and Jam= Jamalpur

Table 3. Mean performances of five lentil genotypes for 1000 Seed weight and *Stemphylium* blight Disease at different locations

Sl. No	Entries	1000 Seed weight (g)						Disease Score (SB*)				
		Ish	Joy	Mad	Jes	Jam	Mean	Ish	Joy	Mad	Jes	Mean
1	BLX-07003-6	20.5	20.3	23.0	22.0	21.0	21.36	1	1	3	2	1.75
2	BLX-07004-7	20.0	20.2	20.9	23.1	21.0	21.04	1	2	3	2	2.00
3	BLX-07004-2	19.9	20.0	30.3	19.1	21.6	22.18	1	1	2	3	1.75
4	BLX-07004-12	21.9	21.5	23.4	21.8	20.1	21.62	1	1	2	2	1.5
5	BARI masur-7	21.3	21.5	23.1	21.6	20.0	21.5	1	1	2	2	1.5
	CV (%)	2.8	2.7	6.87	7.11	0.08	-	-	-	-	-	-
	LSD (0.05)	1.2	1.5	3.1	NS	2.01	-	-	-	-	-	-

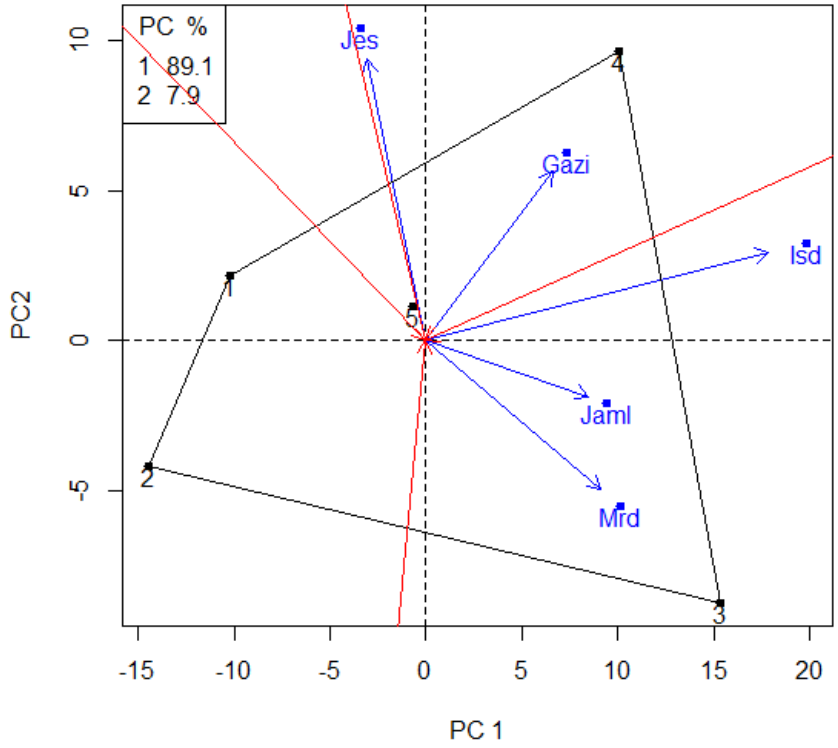
Ish= Ishurdi, Joy= Joydebpur, Mad= Madaripur, Jes= Jessor and Jam= Jamalpur

.

Table 4. Mean performances of five lentil genotypes for yield at different locations

Sl. No	Entries	Yield(kg ha^{-1})					
		Ish	Joy	Mad	Jes	Jam	Mean
1	BLX-07003-6	1615	1605	1650	1600	1545	1603
2	BLX-07004-7	1550	1570	1700	1545	1580	1589
3	BLX-07004-2	1655	1635	1705	1700	1680	1675
4	BLX-07004-12	1600	1615	1635	1685	1650	1637
5	BARI masur-7	1775	1600	1575	1645	1500	1619
	CV (%)	5.44	11.2	18.00	16.30	9.0	-
	LSD (0.05)	215	299	252	242	238	-

Ish= Ishurdi, Joy= Joydebpur, Mad= Madaripur, Jes= Jessor and Jam= Jamalpur (Locations)



[1] BLX-07003-6, [2] BLX-07004-7, [3] BLX-07004-2, [4] BLX-07004-12, [5] BARI Lentil-7

Figure 1. GGE biplot based on yield (kg/ha) of five lentil genotypes

Grain yield

In present studies the yield remained significantly different due to various lentil genotypes in different locations. The entry BLX 07004-2 showed the highest yield of 1675 kg ha^{-1} followed by BLX 07004-12 (1675 kg ha^{-1}) (Table-4). GGE biplot analysis was done to find out stable genotypes among the locations. GGE biplot is exploited for graphical display of G×E pattern of yield trial data with several advantages. The yield of each cultivar in a tested environment is a result of genotypic main effect (G), environmental main effect (E) and genotype × environment (GxE) interaction (Yan and Kang, 2002). In this experiment, the first two PCs of the GGE model explained 97% of variation in G+GE. Five genotypes represent a polygon and the genotypes corner of the polygon most responsive genotypes (Fig.1). The genotypes BLX07004-2 showed most interaction with environment followed by BLX07004-12. All the entries distributed into three sectors. Among the tested location, Jessore, Ishurdi and Madaripur had larger environmental vectors indicating high discriminating ability. GGE biplot of yield showed entry BLX 07004-2 and BLX 07004-12 appeared to be widely adaptive compared to the rest. The out yielded entries were also found resistant reaction to *stemphylium* blight.

Conclusion

The aforesaid results indicate the lines collected from ICARDA showed good variation in days to flowering, days to maturity, pods per plant, 100 seed weight and yield and also disease infection. The evaluation of growth parameters, yield attributes and final yield indicated that lines BLX 07004-2 and BLX 07004-12 can be recommended for new improved variety development program.

References

Amanullah and Hatam M. 2000. Grain yield potential of lentils germplasm. Pakistan J. Biolo. Sci. 3(10): 1553-1555.

Ayub K, Hashmi NI and Khan A. 2004. Performance of exotic lentil varieties under rainfed conditions in Mingora (NWFP) Pakistan. Online J. Biolo. Sci. 1(5): 343-344.

Bakhsh AA, Ghafoor and Malik BA. 1993. Genetic variability and correlation in lentil. Pakistan J. Agric. Res. 14 (2/3): 246-250.

BBS (Bangladesh Bureau of Statistics). 2002 .Year Book of Agricultural Statistics of Bangladesh. Statistics Division Ministry of Planning, Government of Bangladesh .

Bicer BT and Sarkar D. 2004. Evaluation of some lentil genotypes at different locations in Turkey. Interl. J. Agric. Biol. 6(2):317-320.

Chakraborty M and Haque MF. 2000. Lentil genetic variability for grain yield pods and branches. J. Res. Birsa Agril. Univ. 12(2):199-204.

Dimitrove DG. 1973. Effect of growth condition on protein content in lentil. Field crop Abs. 28(1): 33.

Gomez KA and Gomez AA. 1984. Statistical procedure for Agricultural Research. (2nd Ed.). John Willey and Sons, New York. p. 28-192.

Gowda CLL and Kaul AK. 1992. Pulses in Bangladesh. BARI and FAO Pub. p. 50-80.

Hegazy SRE, Selim AT and El-Emam EAA. 2012. Correlation and path co-efficient analysis of yield and some yield components in lentil. Egypt. J. Pl. Breed. 16 (3):147-159.

Kayan N and Olgun M. 2012. Evaluation of yield and some yield components in lentil (*Lens culinaris* Medik). Interl. J. Agric. 2 (6):834- 843.

Purseglove JW. 1968. Tropical Crops. Dicotyledones. Longmans, Green and Co. Ltd. p. 280.

Roy S, Islam MA, Sarker A, Malek MA and Ismail MR. 2013. Determination of genetic diversity in lentil germplasm based on quantitative traits. Australians J. Crop Sci. 7(1):14-21.

Yan and Kang. 2002. GGE Biplot Analysis: A Graphical Tool for Breeders, Geneticists, and Agronomists. CRC Press.

Yaqoob M, Mansoor M, Najibullah and Din N. 2005. Ratta Kulachi- 2004- A high yielding lentil cultivar for rainfed ecologies of NWFP. Indus J. Pl Sci. 4(3): 244-349.