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Short Communication

YIELD PERFORMANCE OF BINA DEVELOPED LENTIL VARIETIES

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Abstract

The field experiment was conducted at research farm of BINA sub-station Ishurdi during the winter (rabi) season, 2016-2017 to find out the best yield performance of BINA developed lentil varieties that are able to increase lentil production in Bangladesh within short maturity period. BINA developed nine lentil varieties (Binamasur-1, Binamasur-2, Binamasur-3, Binamasur-4, Binamasur-5, Binamasur-6, Binamasur-7, Binamasur-8 and Binamasur-9) were tested in Randomized Complete Block Design (RCBD) with three replications to evaluate their morphological and yield contributing characters. The performance of Binamasur-8 is the best for maximizing seed yield with short maturity period. Binamasur-8 produced 2.37 t ha^{-1} yields with 88 maturity days. Primary branch production is more important than plant height in achieving higher seed yield in lentil. More primary branches ensure more pod number which also increase seed number and finally produce more seed yield. Seed size was also responsible for high yield achievement. Among all the BINA developed lentil varieties Binamasur-8 was found pioneer followed by Binamasur-5 in respect of seed yield with earliest maturity period. Therefore, it will be possible to increase lentil production in Bangladesh by cultivating Binamasur-8.

Key word: Lentil, morphological and yield contributing characters

Legumes are used worldwide as an inexpensive meat alternative and are considered the second most important food source after cereals (Kouris-Blazos *et al.*, 2016). Major legume crops grown in Bangladesh are lentils, chickpea, mungbeans, blackgrams, grass peas. Lentil (*Lens culinaris* Medik) contributes largest production percentage (64%) which ranks the first position regarding area and production in Bangladesh (BBS, 2019). Lentil grain contains 10% protein, 34.57% carbohydrate, 0.63% free amino acid and 2% polyphenol content (Khatun *et al.*, 2021). These polyphenol compounds are most bioactive component for human health. In addition to protein, lentil is a rich source of minerals and vitamins as human food, while the straw serves as high-value animal feed (Rasheed *et al.*, 2010). Not only that, its cultivation enriches soil nutrient status by adding nitrogen, carbon and organic matter, which promotes sustainable crop production system (Mondal *et al.* 2013a).

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Lentil is an important legume crop that plays a significant role in nutritional security of our growing population. So, it is necessary to increase its production. In South Asia, the yield of lentil remains low and average seed yield on a country basis is below 1.0 t ha^{-1} (SAIC, 2018. Further, the area under lentil cultivation in South Asia has been decreasing at a faster rate because of increasing demand for staple grains like rice and wheat (Rahman and Ali, 2011). Lentil has been identified as a narrow adapted crop and the principal constraint of lentil production is its low yield potential because of undesirable plant type (Mondal *et al.,* 2013b). Several causes are responsible for low yield of lentil such as the use of traditional local cultivars; low plant density, weed infestation and poor crop management practices constitute the major ones. The main cause of decreasing lentil production in Bangladesh is to cultivate traditional low yielding long duration variety. Therefore, it needs to increase its production with cultivating high yielding short duration lentil variety.

Bangladesh Institute of Nuclear Agriculture (BINA) has developed nine lentil varieties through chemical and physical mutagenesis and different cultivars contain different special characters. Therefore, the present research work was conducted to find out the best yield performance of BINA developed lentil varieties that are able to increase lentil production in Bangladesh within short maturity period.

The study was conducted at research farm of BINA Sub-station, Ishurdi during the winter (rabi) season, 2016-2017. The land is medium high having sandy loam textured soil with soil pH 7.65 (Annonymous, 2012). The experiment was laid out in Randomize Complete Block Design (RCBD) with three replications. The unit plot size was 2.5 m × 2 m and seeds were sown in rows with spacing 30 cm. Nine BINA developed lentil varieties such as Binamasur-1, Binamasur-2, Binamasur-3, Binamasur-4, Binamasur-5, Binamasur-6, Binamasur-7, Binamasur-8, Binamasur-9 were used as planting material. Recommended intercultural practices such as weeding, thinning, irrigation and application of pesticides were done as and when necessary for proper growth and development of the plants. Nitrogen, phosphorus and potassium were provided during final land preparation at the rate of 25, 77 and 32 kg ha^{-1} in the form of Urea, Triple Super Phosphate (TSP) and Muriate of Potash (MP), respectively and 4 kg ha^{-1} zinc sulphate.

At maturity, ten plants were randomly sampled for recording quantitative traits such as plant height, number of main branch, number of pods per plant, number of seeds per pod, 1000 seed weight of each variety following IBPGR Descriptors (Anonymous, 2013). Grain yield was recorded through whole plot harvesting. All collecting data were analyzed statistically to one-way analysis of variance (ANOVA) using PROC GLM in SAS program (SAS Institute, 1989). The values were expressed as the mean ± standard deviation (SD) calculated using Microsoft Excel 2010. All assay data were subjected 3 mean values were compared with Duncan's Multiple Range Test at 0.05 level of Type I error.

Morphological Characters

Lentil varieties show significant differences in morphological characters such as plant height, days to maturity, and number of branch per plant were shown in Table 1. Among all BINA developed lentil varieties the Binamasur-2 was shown the highest (48.93 ± 1.21 cm) plant height that was statistically similar with Binamasur-7 (46.00 ± 2.55 cm), Binamasur-8 (47.07 ± 2.69 cm) and Binamasur-9 (47.73 ± 2.15 cm). Whereas, Binamasur-5 was the shortest (34.93 ± 2.52 cm) that was statistically different from other varieties. Maturity duration is lowest in Binamasur-8 (88 days) followed by Binamasur-6 (94 days). Maximum maturity duration was observed in Binamasur-1 (104 days). Binamasur-8 produced highest number of primary branches (3.27 ± 0.30 branches plant^{-1}) followed by Binamasur-6 (3.20 ± 0.80 branches plant^{-1}). But the number of primary brunch was statistically similar in all varieties.

Table 1. Morphological characters of BINA developed lentil varieties

Variety	Plant height (cm)	Days to maturity	No of branch plant^{-1}
Binamasur-1	40.83 ± 1.64^{b}	104	2.50 ± 0.30^{a}
Binamasur-2	48.93 ± 1.21^{a}	96	3.03 ± 0.60^{a}
Binamasur-3	41.90 ± 2.13^{b}	100	3.10 ± 0.30^{a}
Binamasur-4	41.90 ± 0.60^{b}	97	3.10 ± 0.90^{a}
Binamasur-5	34.93 ± 2.52^{c}	96	2.77 ± 0.90^{a}
Binamasur-6	39.50 ± 1.01^{b}	94	3.20 ± 0.80^{a}
Binamasur-7	46.00 ±2.55^{a}	96	2.87 ± 0.60^{a}
Binamasur-8	47.07 ± 2.69^{a}	88	3.27 ± 0.30^{a}
Binamasur-9	47.73 ± 2.15^{a}	98	2.80 ± 0.40^{a}

In a column figures with same letter (s) do not differ significantly whereas figures with dissimilar letter (s) differ significantly (as per DMRT, $p \leq 0.05$),

Yield attributes of BINA developed lentil varieties

Yield attributes of BINA developed lentil varieties also showed significant differences that was elucidated in Table 2. Maximum number of pod was produced in Binamasur-8 (109.31 ± 1.00 pods plant^{-1}) that was statistically different from other varieties and followed by Binamasur-5 (103.93 ± 1.10 pods plant^{-1}). In contrast minimum number of pod was produced by Binamasur-3 (67.97 ± 1.80 pods plant^{-1}). Similarly highest number of seed per pod was counted in Binamasur-8 (1.86 seed pod^{-1}) followed by Binamasur-5 (1.83 ± 0.06 seeds pod^{-1}) and Binamasur-9 (1.83 ± 0.06 seeds pod^{-1}) and all are statistically similar. Binamasur-8 showed bolder seed thus 1000 seed weight found maximum (22.08 ± 0.26g) followed by Binamasur-5 (21.31 ± 0.43 g) and both were statistically different. On the other hand, the lowest 1000 seed weight was recorded in Binamasur-1 (14.31 ± 0.89g) followed by Binamasur-2 (15.84 ± 0.61 g) and Binamasur-3 (15.61 ± 0.93 g). Highest amount of seed yield was collected from Binamasur-8 (2.37 ± 0.06 t ha^{-1}) that was statistically different from other varieties.

Table 2. Yield attributes of BINA developed lentil varieties

Variety	Pods plant^{-1} (no.)	Seeds pod^{-1} (no)	1000-seed weight (g)	Seed yield (t ha^{-1})
Binamasur-1	105.23 ± 1.20^{b}	1.53 ± 0.31^{bc}	14.31 ± 0.89^{e}	1.63 ± 0.12^{e}
Binamasur-2	102.74 ± 0.57^{c}	1.67 ± 0.12^{ab}	15.84 ± 0.61^{de}	1.87 ± 0.05^{bc}
Binamasur-3	67.97 ± 1.80^{g}	1.37 ± 0.06^{c}	15.61 ± 0.93^{de}	1.83 ± 0.05^{cd}
Binamasur-4	83.30 ± 1.11^{e}	1.43 ± 0.06^{bc}	17.31 ± 1.77^{d}	1.90 ± 0.06^{bc}
Binamasur-5	103.93 ± 1.10^{b}	1.83 ± 0.06^{a}	21.31 ± 0.43^{b}	2.07 ± 0.06^{b}
Binamasur-6	67.40 ± 0.79^{g}	1.60 ± 0.20^{abc}	19.43 ± 1.21^{c}	2.03 ± 0.15^{b}
Binamasur-7	76.63 ± 2.32^{f}	1.47 ± 0.15^{bc}	16.60 ± 0.86^{d}	2.03 ± 0.20^{b}
Binamasur-8	109.31 ± 1.00^{a}	1.86 ± 0.05^{a}	22.08 ± 0.26^{a}	2.37 ± 0.06^{a}
Binamasur-9	88.70 ± 1.47^{d}	1.83 ± 0.06^{a}	17.33 ± 0.47^{d}	2.02 ± 0.11^{b}

In a column figures with same letter(s) do not differ significantly whereas figures with dissimilar letter (s) differ significantly (as per DMRT, $p \leq 0.05$),

Maximum number of pods per plant, no of seeds per pod and seed size contributed to maximum yield production on Binamasur-8. Minimum yield production was observed in Binamasur-1 (1.63 ± 0.12 t ha^{-1}). Though maturity duration was shortest among all BINA developed lentil variety but production of yield shown highest in Binamasur-8. This result indicating that primary branch production is more important than plant height in achieving higher seed yield in lentil. More primary branches ensure more pod number which also increase seed number and finally produce more seed yield. Seed size was also responsible for high yield achievement. So, it can be concluded that seed yield is positively correlated with branch production as well as number of pod per plant and seed size. Similar result was also reported by many workers in lentil (Khatun *et al.,* 2016, Mondol *et al.,* 2013a, Karadavut, 2009, Anzam *et al*., 2005, Kakde *et al*., 2005, Yadav *et al*., 2003) all were reported that seed yield was positively and significantly correlated with branch number as well as number of pod per plant and seed size.

It may be concluded that Binamasur-8 is the best for maximizing seed yield with short maturity period. Binamasur-8 produced 2.37 t ha^{-1} yields with 88 maturity days. Among all the BINA developed lentil varieties Binamasur-8 was found pioneer followed by Binamasur-5 in respect of seed yield with earliest maturity period. So, Binamasur-8 may be cultivated countrywide for increase lentil production.

Reference

Anzam, M.S., Ali, A., Iqbal, S.M. and Haqqani, A.M. 2005. Evaluation and correlation of economically important traits in exotic germplasm of lentil. Int. J. Agric. Biol., 7: 959-961.

Anonymous. 2012. Fertilizer Recommendation Guide 2012. Bangladesh Agricultural Research Council (BARC). Farmgate, Dhaka. p. 98.

Anonymous. 2013. Grain Composition. Lupin Food Australia. Perth: Australia.

BBS (Bangladesh Bureau of Statistics). 2019. Yearbook of Agricultural Statistics of Bangladesh. Reproduction, Documentation and Publication Wing, BBS, Secretariat, Dhaka.

Kakde, S.S., Sharma, R.N., Khilkre, A.S. and Lambade, B.M. 2005. Correlation and path analysis studies in lentil. J. Soil Crops. 15: 67-71.

Karadavut, U. 2009. Path analysis for yield and yieldcomponents in lentil.Turkish J. Field Crops. 14: 97-104.

Khatun, S. and Kim, T. 2021. Phenolic compound, antioxidant activity and nutitional components of five legume seed. *Am J Biomed Sci & Res*. 12(4). 328-334. doi: 10.34297/AJBSR.2021.12.00

Khatun, S., Mondal, M.M.A., Khalil, M.I., Mollah, M.M.I. and Kamruzzaman, M., 2016. Impact of Morpho-Physiological Traits on Seed Yield of Lentil (*Lens culinaris* Medik). International J. Agric. Innov. Res. 5(1): 2319-1473.

Kouris-Blazos, A., Belski, R., 2016. Health benefits of legumes and pulses with a focus on Australian sweet lupins. As. Pac. J. Clin. Nutr. 21: 1-17.

Mondal, M.M.A., Puteh, A.B., Malek, M.A., Roy, S. and Rafii. 2013a. Contribution of morpho-physiological traits on yield of lentil (*Lens culinaris* Medik). Australian J. Crop Sci., 8: 1167- 1172.

Mondal, M.M.A., Puteh, A.B., Malek, M.A. and Kabir, A.K.M.R. 2013b. Flowering pattern and reproductive efficiency in lentil. Legume Res. 36 (2): 153-157.

Popelka, J.C., Terryn, N. and Higgins, T.J.V. 2004. Gene technology for grain legumes: can it contribute to the food challenge in developing countries? Plant Sci. 167: 195-206. doi: 10.1016/j.plantsci.2004.03.027.

Rahman, M.A. and Ali, M.O. 2011. The causes of decrement in pulse production and its possible remedy. Proceedings of the International Conference on 'Pulses in South Asia' held at the Bangladesh Agricultural Research Institute, Gazipur-1701, Bangladesh. 17-19 February 2011. pp. 91-94.

Rasheed, M., Jilani, G., Shah, I.A., Najeeb, U. and Iqbal, T. 2010. Genotypic variants of lentil exhibit differential response to phosphorus fertilization for physiological and yield attributes. Acta Agriculture Scandania., Section-B: Soil Plant Sci. 60: 485-493.

SAIC. 2018. Annual report of SAARC Agricultural Information Centre (SAIC), Farmgate, Dhaka-1215.

SAS Institute Inc., 2018. SAS/STAT user's guide, Release 6.03, Ed. Cary, NC.

Staniak, M., Księżak, J., Bojarszczuk, J. 2014. Mixtures of legumes with cereals as a source of feed for animals. In: Pilipavicius V, editor. Organic Agriculture Towards Sustainability. In Tech: Croatia. pp. 123-145.

Yadav, S.S., Phogat, D.S., Solanki, I.S. and Tomer, T.S. 2003. Character association and path analysis in lentil. Indian J. Pulse Res. 16: 22-24.

Yorgancilar, M. and Bilgicli, N., 2014. Chemical and nutritional changes in bitter and sweet lupin seeds (*Lupinusalbus* L.) during bulgur production. J. Food Sci. Technol. 51: 1384-1389.