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Assessment of medium duration lentil varieties in New Alluvial Zone of West Bengal

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ABSTRACT

A field experiment was conducted at District Seed Farm, AB block, Kalyani, Bidhan Chandra Krishi Viswavidyalaya, West Bengal, during rabi seasons of 2015-16 and 2016-17 respectively to assess the performance of 8 medium duration lentil varieties (BM-1, BM-2, BM-3, BM-4, BM-5, BM-6, BM-7 and Subrata) in terms of phenology, yield attributing characters and yield in randomized block design replicated thrice. The result of the experiment revealed that among the 8 varieties evaluated, BM-2 produced significantly highest yield (1604.46 kg ha^{-1}) followed by BM-7 (1381.33 kg ha^{-1}). The trend remained the same as per pooled data, with BM-2 recording higher100 seed weight (2.09 g), highest number of primary branches plant-1 (4.85) and maximum pods plant-1 (102.89) respectively. In respect to phenology, yield and yield attributing characters, BM-2 variety performed better as compared to all other lentil varieties. The maximum plant height was witnessed in Subrata (43.64 cm) followed by BM-2 (38.27 cm) respectively. On analyzing the pooled data over two years, it was revealed that, the variety BM-2 along with its good yield attributes was also an early maturing one (104.70 days) compared to others. Hence, this variety could be considered for recommendation in New Alluvial Zone of West Bengal. Other short duration varieties tested were BM-6 (107.25 days) and BM-7 (107.95 days) respectively. Subrata waslate maturing type and took 118.42 days to complete its life cycle.

Keywords: Lentil, phenology, variety, yield

Malnutrition and poverty are considered as major issues for concern in India. Since early civilization in different continents across the globe, grain legumes have been a part of balanced diet together with cereals. Food legumes popularly known as pulses are dietary protein in the daily diet of human beings as well as animal feed. A sustainable diet for vegetarians may not be possible without the protein-rich grain legumes. Nutritional security in India and in other developing countries can only be achieved by reducing the post-harvest losses of crops particularly protein rich legumes (IIPR, Kanpur, 2007). Lentil (*Lens culinaris* Medikus subsp. *culinaris*) is a lens-shaped grain legume which is well known as a nutritious human food.Lentil has adequate amount of carbohydrates, protein, vitamins, minerals (K, P, Fe, and Zn), dietary fiber, higher energetic value (de Almeida Costa *et al.*, 2006) and oleic, linoleic and palmitic acid (Roy *et al.*, 2009) for human nutrition. Among the cool season food legumes (CSFL), lentil is one of the most potential winter pulse crops and ranks next only to chickpea in India. Lentil possess enough potential for increasing farm income as well as cropping intensity (Das *et al.*, 2013).

Apart from growing as an important *rabi* crop in West Bengal, lentil is a potential crop in the adjoining provinces of India (Bihar, Jharkhand and Uttaranchal) as well as abroad (Nepal Bangladesh and Pakistan) because of consumer's preference (Roy *et al.*, 2009). But in W.B., the major issues like late transplanting of monsoon rice as well as long duration rice habit possess delay in vacating land in mid to end of November. Thus it delays the sowing of post rice winter pulses making it susceptible to drought and terminal heat stress resulting in low productivity. Keeping a view of growing population, there is a need to increase the production of pulses along with cereals, which unfortunately is not happening. The rate of production of lentil has become stagnant in last few years. This is mainly because of the non-replacement of old existing varieties by the farmers. Hence it is of dire importance to come up with new improved lentil varieties suitable for a particular zone which can adapt itself to the changing climate scenario along with its profitability to the poor farming community of our country. Thus, this experiment was taken up to access and select best high yielding medium duration exotic varieties thatshould beselected and promoted in the particular zone of West Bengal.

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Table 1:Phenological characteristics of lentil varieties in new alluvial zone of West Bengal

Variety	Days to flower initiation			Days to 50% flowering			Days to 100% flowering			Days to maturity			Plant Height (cm)		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
B. Masoor 1	48.00	44.50	46.25	58.50	54.00	56.25	62.61	60.50	61.56	115.00	111.11	113.06	35.80	34.57	35.18
B. Masoor 2	51.50	47.61	49.56	53.00	52.61	52.81	63.50	59.00	61.25	104.00	105.39	104.70	37.73	38.80	38.27
B. Masoor 3	51.50	50.83	51.17	58.50	55.72	57.11	61.17	58.78	59.97	108.50	109.78	109.14	33.40	35.03	34.22
B. Masoor 4	50.50	47.94	49.22	57.50	59.28	58.39	59.28	60.22	59.75	109.00	111.89	110.45	34.90	36.53	35.72
B. Masoor 5	50.50	47.72	49.11	57.00	54.00	55.50	60.17	58.17	59.17	114.50	112.27	113.38	31.47	37.13	34.30
B. Masoor 6	49.50	45.16	47.33	53.00	55.50	54.25	63.00	60.00	61.50	108.50	106.00	107.25	33.26	34.20	33.73
B. Masoor 7	52.00	51.83	51.92	62.00	58.72	60.36	65.33	62.50	63.92	107.50	108.39	107.95	37.53	34.47	36.00
Subrata	60.00	59.44	59.72	69.00	65.44	67.22	72.55	70.39	71.47	117.00	119.83	118.42	42.93	44.35	43.64
S.Em (±)	**1.18**	**0.80**	**0.79**	**0.58**	**0.83**	**0.49**	**0.76**	**0.50**	**0.51**	**1.06**	**0.89**	**0.77**	**0.99**	**0.96**	**0.75**
LSD(0.05)	**3.64**	**2.44**	**2.45**	**1.78**	**2.53**	**1.50**	**2.32**	**1.52**	**1.56**	**3.26**	**2.73**	**2.37**	**3.06**	**2.94**	**2.29**

Table 2: Yield and yield attributing characters of lentil varieties in new alluvial zone of West Bengal

Variety	Primary branches plant^{-1}			Number of pods plant^{-1}			100 seeds weight			Yield (Kg.ha^{-1})		
	2015-16	**2016-17**	**Pooled**	**2015-16**	**2016-17**	**Pooled**	**2015-16**	**2016-17**	**Pooled**	**2015-16**	**2016-17**	**Pooled**
B. Masoor 1	2.80	2.90	2.85	88.00	90.94	89.47	1.57	1.60	1.58	1459.16	1001.50	1230.33
B. Masoor 2	5.20	4.50	4.85	99.06	106.72	102.89	2.13	2.04	2.09	1628.74	1580.18	1604.46
B. Masoor 3	3.20	3.20	3.20	96.30	88.30	92.30	1.89	1.90	1.89	1299.62	950.69	1125.15
B. Masoor 4	2.90	2.84	2.87	91.90	95.13	93.52	1.81	1.77	1.79	1334.57	1050.92	1192.74
B. Masoor 5	2.50	3.32	2.91	94.30	86.10	90.20	1.72	1.84	1.78	1076.24	763.89	920.06
B. Masoor 6	3.40	3.20	3.30	99.90	101.11	100.51	1.93	1.86	1.90	1080.43	1125.00	1102.72
B. Masoor 7	3.50	3.10	3.30	108.10	96.72	102.41	1.57	1.50	1.54	1644.15	1118.51	1381.33
Subrata	2.90	2.80	2.85	50.30	58.30	54.30	2.05	2.20	2.12	1037.91	946.93	992.42
S.Em (±)	**0.22**	**0.16**	**0.10**	**0.61**	**0.76**	**0.57**	**0.09**	**0.08**	**0.05**	**5.76**	**35.79**	**18.31**
LSD(0.05)	**0.69**	**0.49**	**0.32**	**1.86**	**2.32**	**1.74**	**0.29**	**0.24**	**0.15**	**17.64**	**109.61**	**56.08**

MATERIALS AND METHODS

The experiment was conducted during *rabi* season of 2015-16 and 2016-17at the District Seed Farm, AB block,Kalyani, BidhanChandra KrishiViswavidyalaya, Nadia, West Bengal,India. As per analysis of soil samples, the experimental field was a medium land with well-drained gangetic alluvial soil (order: Inceptisol), that belonged to the class of sandy loam with medium fertility, almost neutral in reaction, organiccarbon 0.49%, available nitrogen 225.25 kg ha^{-1}, phosphorus 25.81 kg $ha^{-1}$and potassium187.55 kg ha^{-1}. The monthly rainfall recorded during *rabi* season of both the years was very scanty in nature. Maximum and minimum rainfall occurred during cropping period of 2015-16 (49.3 & 3.0 mm) and 2016-17 (38.8 & 2.6 mm) was recorded in the month of March and January respectively. The experiment was laid out in randomized block design involving eight lentil varieties (Bari Masoor-1, Bari Masoor-2, Bari Masoor-3, Bari Masoor-4, Bari Masoor-5, Bari Masoor-6, Bari Masoor-7 and Subrata) which were replicated thrice. The seeds were sown on plot of 4 × 3 m area in line. Lentil varieties were sown with a spacing of 25 cm × 10 cm after harvesting of *kharif* rice. Fertilizer was thoroughly mixed with the soil at the time of land preparation @ 20:40:40 kg ha^{-1} N: P_2O_5:K_2O. The phenological observations of lentil varieties were noted by following regular field inspection procedure. The data on plant height and yield attributes were recorded from 5 plants, selected randomly from each plot at maturity stage of crop.The data obtained in the study were analyzed using 'Analysis of Variance' technique (ANOVA) following standard statistical procedures (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Phenology

A significant variation was observed among the lentil varieties in terms of days to 1st flower blooming, 50% flowering, 100% flowering and days to attain maturity. Initiation of flower took 48 to 60 days after sowing in 2015-16 and 44.50 to 59.44 days after sowing in 2016-17 respectively (Table 1). Pooled data revealed that the variety Bari Masoor 1 took minimum days (46.25) to initiate flower which was statistically at par with Bari Masoor 6 (47.33 days) and Subrata took maximum days (59.72) to flower initiation (Table 1). Days to 50% flowering (52.81) was fastest in Bari Masoor 2 and slowest variety to reach 50% flowering was Subrata (67.22 days) as per pooled data of 2015-16 and 2016-17 respectively (Table 1). Days to 100% flowering (59.28) was fastest in variety Bari Masoor 4 in 2015-16 and Bari Masoor 5 (58.17) which was statistically at par with Bari Masoor 2 (59) and Bari Masoor 3 (58.78) in 2016-17 respectively.According to pooled data of the present investigation, variety Subrata and Bari Masoor 5 required maximum and minimum time (71.47 and 59.17 days) to attain full bloom stage (Table 1).

Among the 8 lentil varieties characterized phenologically, Subrata took maximum days to initiate flower, 50% flowering and 100% flowering. Similar type of work was also reported by Dixit *et al.* (2011) where he evaluated twenty nine lentil varieties as early, medium and late flowering category, among which PL406 was categorized as medium flowering type.The varieties took about 104 to 117 days and 105.39 to 119.83 days to mature during both the year of experiment with very early duration (104 days) in Bari Masoor 2 during 2015-16 and almost 105.39 days during 2016-17. The pooled data over two growing seasons also revealed that Subrata was the last one to mature among the varieties *i.e*. almost 118.42 days whereas Bari Masoor 2 matured in 104.70 days (Table 1). The varietal evaluation based on phenological stages was reported by Reja *et al.* (2017) for variety Subrata. He also reported that Subratatook 62 days to initiate flower, 70 days for 50% flowering and 103 days to mature.

Plant height

Plant height at maturity along the varieties varied significantly between 31.47 to 42.93 cm during the year 2015-16 and 34.20 to 44.35 cm in 2016-17 respectively. In terms of pooled data, maximum plant height at maturity was observed in Subrata (43.64 cm) followed by Bari Masoor 2 (38.27 cm) respectively. Similar findings on plant height of Bari Masoor 2 was also reported by Sarker *et al.* (2004) in Bangladesh.

Yield components

The varieties differed significantly in respect to yield and yield attributes during both the year of experiment (Table 2). Number of primary branches $plant^{-1}$ differed between 2.50 to 5.20 during 2015-16 and 2.80 to 4.50 in 2016-17 with maximum in variety Bari Masoor 2 (5.20 and 4.50) during the consecutive years of experimentation. In accordance with the pooled data, primary branches $plant^{-1}$ was maximum in Bari Masoor 2 (4.85) whereas Subrata recorded minimum primary branches $plant^{-1}$ (2.85) which was statistically at par with Bari Masoor 1 (Table 2). In the year 2015-16, highest number of pods $plant^{-1}$ was recorded in variety Bari Masoor 7 (108.10) followed by Bari Masoor 6 (99.90) which was statistically similar with Bari Masoor 2, whereas during the second year Bari Masoor 2 yielded maximum pods $plant^{-1}$ (106.72) followed by Bari Masoor 6 (101.11) and Bari Masoor 7 (96.72) respectively (Table 2). From pooled data of the investigation, highest number

of pods plant^{-1} was observed with variety Bari Masoor 2 (102.89). Seed size or weight revealed the seed boldness whether it is macrosperma or microsperma type. 100 seed weight varied significantly from 1.57 to 2.13 g and 1.50 to 2.20 g during 2015-16 and 2016-17 respectively. Pooled data revealed all 8 lentil varieties as microsperma type. In terms of pooled data, highest 100 seed weight was noticed in variety Subrata (2.12) followed by Bari Masoor 2 (2.09) and Bari Masoor 6 (1.90) respectively. Dixit *et al*. (2009) and Reja *et al*. (2017) also characterized lentil genotypes and noted seed index of KLS 218 as 1.8g and 1.79g respectively.

Yield

Accessing data's of two years, yield potentiality of these varieties varied significantly between 1037.91 to 1644.15 kg ha^{-1} and 763.89 to 1580.18 kg ha^{-1} respectively during 2015-16 and 2016-17. The highest yield among the 8 lentil varieties was noticed in Bari Masoor 7 (1644.15 kg ha^{-1}) and Bari Masoor 2 (1580.18 kg ha^{-1}) during 2015-16 and 2016-17 respectively. As per pooled data, based on yield potentiality, Bari Masoor 2 ranked first (1604.46 kg ha^{-1}) followed by Bari Masoor 7 (1381.33 kg ha^{-1}) and Bari Masoor 5 was the lowest yielder (920.06 kg ha^{-1}) among the varieties.

As per the witnessed results, among 8 medium duration lentil varieties compared, Bari Masoor 2 variety took least days to 50% flowering, 100% flowering as well as took minimum number of days to mature (104.70 days). The plant height was also 2nd highest (38.27 cm) in Bari Masoor 2 among all the varieties in the investigation. This particular variety had maximum number of primary branches plant^{-1} (4.85), highest number of pods plant^{-1} (102.89) and also recorded 2nd highest 100 seed weight (2.09 g) according to pooled data of both growing seasons. The yield was also maximum in Bari Masoor 2 variety *i.e*. 1604.46 kg ha^{-1} respectively.The yield of Bari Masoor 2 was also reported as 1800 kg ha^{-1} by Sarker *et al.* (2004). In respect to phenology, yield and yield attributing characters, Bari Masoor 2 variety performed much better in comparison to other lentil varieties.

Hence, Bari Masoor 2 variety can be recommended for this zone to improve the livelihood and sustainability of the farmers. The result needs further validation for attaining perfection.

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