

Performance of Lentil (*Lens culinaris* Medik. sub sp. *culinaris*) Varieties in Agro-climatic Condition of Tripura

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ABSTRACT

Tripura is one of the major lentil-consuming states in India and imports nearly 90% of its lentils. The lentil productivity of Tripura is very less as compared to the national productivity. The low productivity in the region could be attributed to lack of high-yielding cultivars. Considering the above facts, one field experiment was planned to evaluate lentil varieties for yield and yield-related traits in agro-climatic conditions of Tripura at the Experimental Farm of the College of Agriculture, Lembucherra, Tripura (W), India during 2021-22. The 16 cultivars (totaling 16 varieties or lines) were tested in a complete Randomized Block Design (RBD) and replicated thrice. The variety IPL 534 had highest germination percentage (93.07%) closely followed by Bari Masoor-5 (89.61%). All the lentil varieties took almost 48-52 days for flower initiation and 54-61 days for 50% flowering. The highest plant height was recorded by ILL10803 followed by IPL 534 and the maximum root length was recorded by BINA-8 followed by BINA-10. Plant population at harvest was maximum for IPL-534 followed by Bari Masoor-5 variety. The highest seed yield was observed in IPL-534 variety followed by Bari Masoor-5 which was significantly higher over rest of the varieties. According to the experimental results, the IPL-534 lentil variety not only had higher germination and plant stand at harvest in Tripura conditions, but also had higher growth and yield attributes, which significantly contributed to its satisfactory seed yield in Tripura's upland conditions for sustainable agriculture.

Key words : Lentil, Acidic soil, Crop ontogeny, Germination percentage, Growth attributes, Yield.

Introduction

Legumes, and in particular pulses, are a source of protein for both human consumption and animal feed. They play an important role in sustainable and future-orientated food and feed systems

(Vasconcelos *et al.*, 2019). They fix atmospheric nitrogen and give farmers independence from the need to purchase mineral nitrogen fertilizer. Legumes in total provide numerous beneficial effects to the ecosystem (Squire *et al.*, 2019). Among the

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many pulse species, lentils (*Lens culinaris* Medik. subsp. *culinaris*) are used for human consumption throughout India. Lentils play a major role in the food and nutritional security of millions, particularly among low income Indian families, because of the high protein content of their seed. Lentil seed is a vital source of protein, with a mean of 28.3% ranging from 15.9 to 31.4% (Grusak, 2009), especially for the poor, who cannot afford animal products. As is the case for many pulses, lentils play an important role as a rotation crop, enhancing soil fertility and providing other environmental services in production systems. Besides fixing atmospheric N and benefitting the succeeding crop with residual nitrogen in soil, lentil is also adapted to local climatic and soil fertility conditions (Srinivasa Rao *et al.*, 2012).

Tripura being one of the seven sister states of the north eastern India, is a land of beauty with a unique feature of land topography and cultural heritage. Tripura is one of the major lentil-consuming states in India and imports nearly 90% of its lentils, so the state must prioritize pulse production to achieve pulse self-sufficiency and meet the state's protein demand. In Tripura, where a large part of the moisture deficit upland area remains fallow after *Kharif* rainfed crops, lentil has a very good potential for increasing farm income as well as cropping intensity (Das *et al.*, 2013). Lentil is the important pulse crop, mainly grown on residual soil moisture and is a prominent source of vegetable protein (Singh *et al.*, 2011).

Being a pulse crop, it also improves soil fertility and is a very good option for crop rotation. Lentil cultivation in Tripura faces

several constraints, such as water scarcity during post-monsoon season, lack of irrigation facilities, short time lag after rice harvest for seed sowing and flower dropping and poor pod setting in late sown crops as a result, only mono cropping of rice is practiced and the farmers leave their land fallow. It also faces some more constraints, such as acidic soil conditions, a short time lag after rice harvest for seed sowing and flower dropping, and poor pod setting in late-sown crops. The low productivity in the region could be attributed to a lack of high-yielding cultivars, indigenous microbial inoculation or *Rhizobium* biofertilizer, susceptibility to disease-causing pests, inadequate agronomic management, small-scale post-harvest processing units, market linkage, a lack of awareness among the farmers, etc. In Tripura, where a large part of the moisture-deficient upland area remains fallow after *kharif* rainfed crops, lentil has a very good potential for increasing farm income as well as cropping intensity. The lack of interest in the cultivation of lentils among agricultural producers of Tripura is due to the imperfection of most of the existing varieties. Among the main disadvantages is the low yield and manufacturability of existing varieties.

Currently, the status of lentil production in Tripura is very poor though the demand is high. The main production constraints include the inherent low yielding genetic potential of the widely grown local cultivar and use of traditional agronomic practices. Therefore, this study was designed to evaluate sixteen lentil varieties for their yield and yield-related traits under upland areas of Tripura.

Objectives

To evaluate the performance of lentil varieties on growth attributes, yield-related traits and yield in upland areas of Tripura.

Materials and methods

Experimental site

A field experiment was conducted at experimental farm of the College of Agriculture, Lembucherra, Tripura (W), India (23°56' N latitude and 91°10' E longitude, 160 m from m.s.l.) during 2021-22. Average rainfall of this area is 2100 mm per annum out of which around 80% is received during monsoon season. The soil (Typic Kandihumults) of the experimental field is sandy clay loam and the baseline soil sample had 1.8 g kg⁻¹ SOC, 326 kg ha⁻¹ available nitrogen (N), 0.9 kg ha⁻¹ available phosphorus (P) and 224 kg ha⁻¹ available potassium (K). The pH of soil was 5.2 i.e. acidic in nature. (Soil and water ratio of 1:2.5) (Giri *et al.*, 2021).

Experimental design and crop management

The experiment was performed receiving sixteen varieties/lines of lentil collected from International Centre for Agricultural Research in the Dry Areas (ICARDA), Syria and Bidhan Chandra Krishi Viswa Vidyalaya (BCKV), Kalyani, West Bengal. Lentil was sown at 30 cm × 10 cm spacing (R-R × P-P). The 16 cultivars were tested in complete randomized block design (CRBD) and replicated thrice. Full dose of the recommended NPK as basal were applied (20:40:40 NPK respectively) and as the soil of the experimental field is acidic, it has been observed that very less/no nodule formation has been occurred. Therefore, to compensate the N

requirement, the additional dose of N was applied. Thereafter, foliar sprays of 2% urea at 35 DAS was applied and another foliar spray of 0.5% Borax and 0.1% Ammonium Molybdate was applied just after flowering at 36 DAS. Another spray of 0.5% Borax and 0.1% Ammonium Molybdate was applied just after flowering at 48 DAS.

Statistical analysis

The experimental data pertaining to each parameter of study were subjected to statistical analysis by using the technique of analysis of variance and their significance was tested by “F” test (Gomez and Gomez, 1984). Standard error of means (SEm+) and critical difference (CD) at 5% probability (p=0.05) were worked out for each parameter studied to evaluate differences between treatment means.

Result and discussion

Crop ontogeny

The lentil cultivars were sown on 23rd November during 2021-22 and germinated within 4-5 DAS. All the lentil varieties took 48-52 days for flower initiation and 54-61 days for 50% flowering (**Table 1**). Among the varieties/lines, 10 varieties took almost the same and minimum number of days (47-48 DAS) for flower initiation, whereas, the respective varieties took least number of days (56-57 DAS) for 50% flowering. However, ILL-10803 needed maximum days for flower initiation and 50% flowering (52 & 61 DAS respectively) followed by IPL534 and L4727 variety (50 DAS). In case of days to maturity, BINA-7, L4717 and C₂₃E₂₁ showed early maturity at 97, 98 and 99 DAS respectively, however, IPL-220, IPL-534 and ILL10961 were the late matured varieties (102 DAS to mature). All

the tested varieties were matured in March, therefore, all the varieties were escaped from terminal drought.

Germination Percentage and plant stand at harvest

Germination Percentage and plant stand at harvest, both attributes showed significant changes among the varieties. IPL 534 variety had highest germination percentage (93.07%) closely followed by Bari Masoor-5 (89.61%) (Giri *et.al.*, 2021). Lowest germination of 53.24 % was seen in Moitri variety. Plant population at harvest was maximum (2,95,815 ha⁻¹) for IPL-534 followed by Bari Masoor-5 variety (2,84,271 ha⁻¹), whereas, lowest plant population at harvest (1,63,059 ha⁻¹) was observed for Moitri variety (**Table 1**).

Growth attributes

There was significant variation observed in plant height and root length in all the varieties (Yadav *et al.*, 2015). Plant height was maximum (53.30 cm) for ILL-10803 followed by IPL-534, whereas, lowest plant height (19.37 cm) was noted in BINA-7 variety. BINA-8 was recorded maximum root length (10.18 cm) followed by BINA-10 (9.80 cm), while lowest root length (7.78 cm) was found in ILL10961. (**Figures 1 & 2**). The highest numbers of branches plant⁻¹ were recorded with IPL-534 (14.65) followed by BINA-8 (14.08) while the lowest number of branches plant⁻¹ was recorded with Bari Masoor-7 (6.46) followed by Bari Masoor-5 and BINA-10 (Yadav *et al.*, 2014).

Yield attributes

The maximum number of pods plant⁻¹ was recorded with Bari Masoor-5 (56.8) (Giri *et al.*, 2021) closely followed by IPL 534 (54.5) and BINA-9 (52.5), whereas, the

lowest number of pods plant⁻¹ was recorded with L4717 (16.8). Number of seeds pod⁻¹ was the highest in almost 9 varieties (2.00) however, the least nos. of seeds pod⁻¹ (1.00) was found in ILL10803 variety (**Table 2**). The test weight (weight of 1000 seeds) was recorded to be highest in ILL10803 (46.0 g) followed by IPL 534 (24.3 g). The lowest test weight was recorded Moitri and C₂₃E₂₁ (16.4 g) followed by Bari-Masoor 5 (16.5 g).

Seed yield

The highest seed yield was noted in IPL-534 variety (773.3 kg ha⁻¹) followed by Bari Masoor-5 (716.2 kg ha⁻¹) which was significantly higher over rest of the varieties (Yadav *et al.*, 2015). This may be mainly due to better translocation of photosynthates to the sink and its positive influence on the yield parameters like no. of pods plant⁻¹, no. of seeds pod⁻¹ than other varieties. Test weight (weight of 1000 seeds) was also highest for ILL10803 followed by L4727 which is particularly genetic characteristics. Both these two varieties produced bold seeds which probably contributed mostly for their higher seed yield.

Conclusion

From the experimental study, it can be concluded that there is enough scope for cultivation of high yielding varieties of lentil in upland situation of Tripura. The IPL-534 lentil variety not only had higher germination and plant stand at harvest in Tripura conditions, but also had higher growth and yield attributes, which significantly contributed to its satisfactory seed yield in Tripura's upland conditions for sustainable agriculture. However, more varieties from different institutes should be tested to identify short duration and high yielding varieties suitable for the state.

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Table 1: Effect of different varieties on germination percentage, plant population ha⁻¹, flowering and maturity time of lentil

Treatment	Germination %	Flower initiation	Days to 50% flowering	Final Plant Stand per ha	Days to Maturity
Bari Masoor-5	89.61	48	57	284271	100
Bari Masoor-7	69.26	48	57	216450	100
Moitri	53.24	48	57	163059	100
C₂₃E₂₁	65.58	49	56	204184	99
ILL10802	77.92	48	56	245310	102
ILL10893	72.51	49	56	227272	100
IPL220	56.27	48	56	173160	102
IPL534	93.07	50	58	295815	102
L4717	71.86	48	56	225108	98
L4727	69.91	50	58	218614	100
ILL10961	70.34	48	56	220057	102
BINA-7	73.81	48	56	231601	97
BINA-8	71.64	48	56	224386	100
BINA-9	67.53	48	56	210678	100
BINA-10	74.45	47	54	233766	100
ILL-10803	75.32	52	61	236652	100
SEm(+)	6.24	0.26	0.34	20796	0.08
CD at 5%	18.84	0.80	1.01	62787	0.23

Table 2 : Effect of different varieties on yield attributes and yield of lentil

Treatment	No of branches plant⁻¹	No of pods plant⁻¹	No of seeds pod⁻¹	1000 seed weight (Test Wt) (g)	Seed yield (kg ha⁻¹)
Bari Masoor-5	6.75	56.8	2.0	16.5	716.2
Bari Masoor-7	6.46	37.0	1.9	18.7	437.3
Moitri	10.40	39.3	2.0	16.4	291.0
C₂₃E₂₁	9.36	21.1	2.0	16.4	311.9
ILL10802	10.35	39.6	2.0	17.3	351.9
ILL10893	10.74	29.7	2.0	17.0	515.1
IPL220	11.04	17.3	1.7	19.0	384.9
IPL534	14.65	54.5	1.8	24.3	773.3
L4717	8.16	16.8	2.0	18.9	298.0
L4727	7.66	30.7	1.9	22.4	442.3
ILL10961	10.01	31.0	2.0	17.2	430.3
BINA-7	11.58	27.2	1.9	18.7	655.0
BINA-8	14.08	27.7	2.0	20.3	487.5
BINA-9	9.33	52.5	1.9	19.7	400.9
BINA-10	6.75	21.6	2.0	17.4	300.9
ILL-10803	9.57	24.5	1.0	46.0	547.0
SEm(+)	0.93	2.54	0.06	0.08	26.12
CD at 5%	2.80	7.66	0.19	0.24	78.86

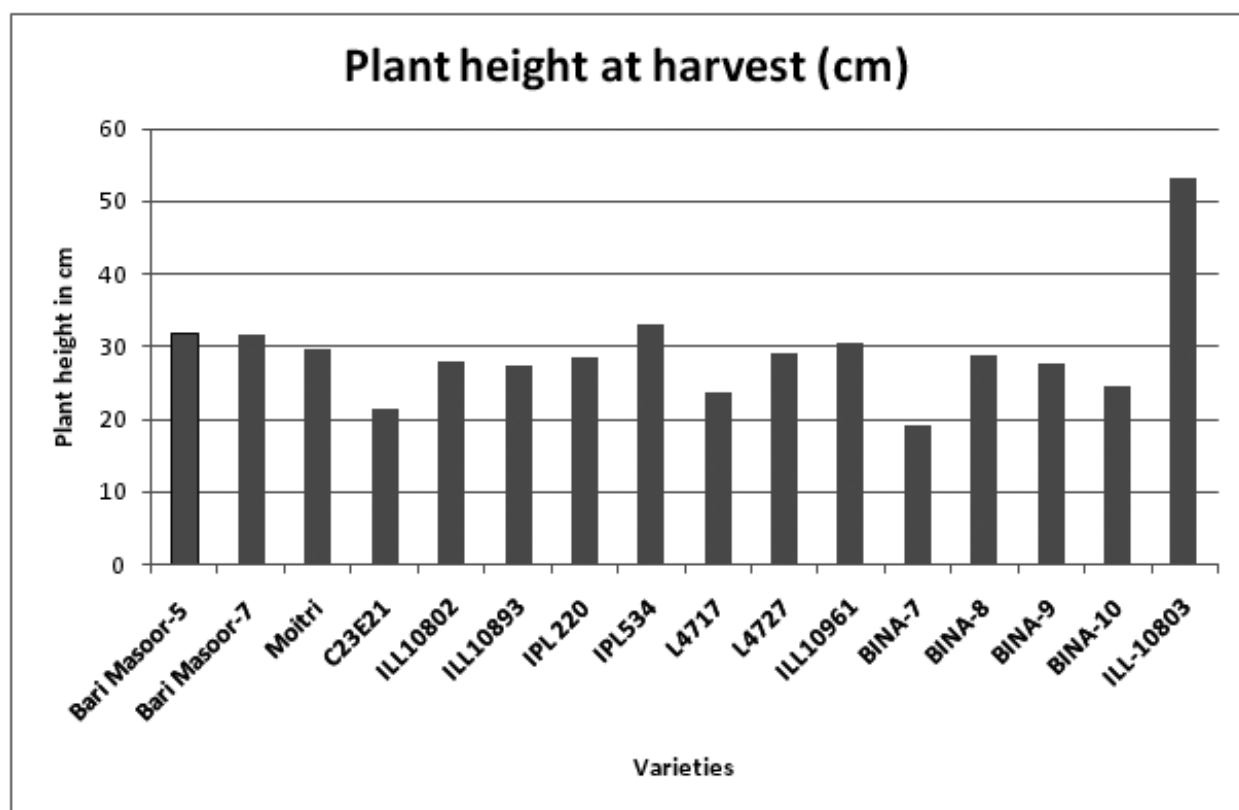


Figure 1 : Effect of different varieties on Plant heights of lentil

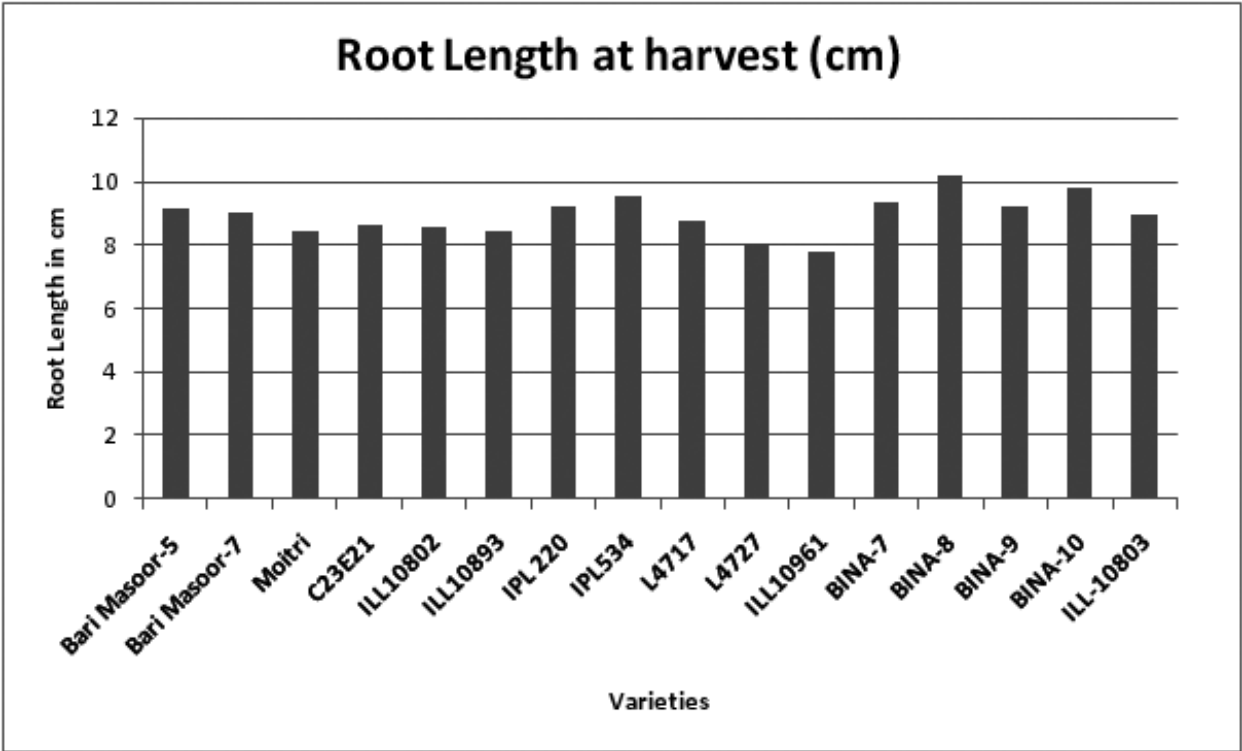


Figure 2 : Effect of different varieties on Root lengths of lentil