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Popularization of scientific package of practices of lentil through cluster front line demonstration in Hathras district of Uttar Pradesh

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Abstract
A study was carried-out during Rabi seasons of 2015-16 and 2017-18 at farmer's fields in eight villages of three blocks in Hathras District of Uttar Pradesh. Clusters Front Line Demonstration (CFLD) on Lentil crop was conducted on an area of 26.2 ha with active participation of 74 farmers with improved technologies composed of DPL -62 and KLS -218 varieties and recommended package of practices. The objective was to find out the best suitable variety of lentil for the area and convincing farmers to adopt lentil as a suitable option in *Rabi* season for higher crop productivity with improved soil health. The maximum grain yield (9.85 q/ha) was obtained from variety KLS -218 which was 39.71% higher than the yield of farmers practice. This was followed by DPL -62 which gave yield 9.42 q/ha with an increment of 36.52% over farmers practice. It was obtained due to varietal intervention grown with recommended package of practices. The highest Biological yield of 30.56 q/ha and 27.03 q/ha was obtained from DPL -62 and KLS -218 variety during 2017-18 and 2015-16 respectively. Highest harvest index (34.85%), followed by KLS – 218 (32.23%), was recorded from the variety DPL – 62. Maximum gross return (Rs. 64025/ha) and, net return (Rs. 43725/ha) was fetched during 2017-18 under the variety KLS-218 grown with recommended package of practices. However, the maximum B: C ratio was registered with the variety DPL -62 during 2015-16 grown with recommended package of practices.

Keywords: Lentil variety KLS-218, DPL -62, yield, HI, CFLD, benefit cost ratio

Introduction
Pulses are the rich and chief sources of proteins, minerals, iron and fibre. The pulse Recommended Dietary Allowances (RDA) for adult male and female is 60 g and 55 g per day, while its per capita availability is @ 42 g per day (Anonymous 2019) [3]. India is the largest producer and consumer of pulses in the world (Tiwari and Shivhare, 2016) [19]. Yet, with stagnation of production in spite of increase in demand, there has been an increasing demand-supply gap for pulses in India. In order to ensure self-sufficiency, the pulse requirement in the country is projected to be about 39 million tonnes by 2050 which necessitates an annual growth rate of 4.0%. Focus on pulses production and consumption can help overcome malnutrition as well as micronutrient deficiencies. Pulses are grown worldwide on about 85.40 M ha with production of 87.40 (Mt) at 1023 kg/ha yields level. India, ranks first in area (29.3 M ha) and production (245 lac tonnes) with 34 per cent and 26 per cent contribution, respectively (Anonymous 2018) [2]. A significant increase in productivity of pulses over Eleventh (662 kg/ha) and Twelfth plans (745 kg/ha) was reported in 2017-18 (835 kg/ha). Lentil with 1.61 Mt production from 1.55 M ha area and 1034 kg/ha productivity also make a record. The contribution of Uttar Pradesh in lentil production was 9.69% (4.47 lakh ton) from 4.78 lakh ha area (31.99%). As a result of Green Revolution, production of rice and wheat went up by over 225% and 808% respectively in 2013– 2014, compared to 1960–1961, but it also have created externalities affecting the ecosystem and human health. These externalities have been caused by intensive food grains cropping systems and by the lack of crop diversity. However, over the same period, production of pulses in India increased only by about 47% (Anonymous 2018(I) [1].
Lentil (*Lens culinaris* Medik) is one of the oldest annual food crops that have been grown for over 8,000 years (Dhuppar *et al*. 2012) [6]. Because of special ability of pulses to fix atmospheric nitrogen, pulses are traditionally indispensable components of cropping systems in India. Moreover, pulses are climate resilient and can be sown in rain-fed areas. Before the inception of chemical fertilizers, pulses were treated as soil fertility charger. Pulses enrich the soil in nitrogenous compounds and improving sustainability of the production system and also nutritional security.

The Hathras district of Aligarh division have a total geographical area of 178968 ha; net sown area 145636 ha with 170% cropping intensity and about 100 percent irrigated. This Indo Gangetic Plain (IGP) having alluvial soils varies in texture from sandy, sandy loam to clay loam. Wheat (79217 ha), Potato (38590 ha) and mustard (7610 ha) are main crops of Rabi season. Maximum farmers of Hathras are continuously following the rice-wheat, pearl millet-wheat, and pearl millet-potato crop rotations since last 15-20 years. These all rotations are heavy nutrient feeder as a result of which soils are degrading and losing their fertility day by day. Moreover, the negative growth in area, production and productivity of the lentil in Uttar Pradesh have been reported by Nasim Ahmad *et al.* (2018) [12] during the years 2001-2016. Several causes are responsible for low yield of lentil of which the use of traditional local cultivars, poor plant density, weed infestation and poor crop management practices constitute the major ones. In spite of agricultural modernization in pulse crops, farmers are still facing diverse technological gap in cultivation. Rai *et al.* 2019 [15] have reported 9% to 75% technological gap in different interventions of pulse production and concluded that to improve this technological gap in adoption of pulse production technologies, large scale demonstration of newer technologies at farmers field are needed. Considering the deteriorating soil health, drastically depleting ground water level the lentil could be adapted and grown well in Hathras as it is being grown in Hasayan, Sikandrarao and Sahapao Blocks followed by *kharif* paddy using local varieties. As lentil is drought tolerant, it has an ample scope for cultivation in Hathras. Keeping these points in view, Clusters frontline demonstrations (CFLD) were carried out in a systematic manner on farmer's field with the objective to find the best suitable variety of lentil for the area and convincing farmers to adopt lentil as a suitable option in Rabi season for higher crop productivity with improved soil health

Materials and Methods

Cluster Front line demonstrations on Lentil were conducted under the National Food Security Mission (NFSM), during Rabi seasons of 2015-16 and 2017-18 at farmer's fields. The demonstrations were laid out in eight villages in three blocks of Hathras District of Uttar Pradesh. Frontline Demonstrations were conducted in a block of two to five hectares land in order to have better impact of the demonstrated technologies on the farmers and field level extension functionaries. The cluster of lentil growing farmers was selected in villages where crop covered a handsome area under lentil to increase the impact of demonstrations. A training programme on scientific cultivation of Lentil was conducted to upgrade the knowledge and skill of farmers and ensuring correct usage and method. Each demonstration was conducted in a block of 0.2 to 0.4 ha area in order to have better impact of the technologies demonstrated against the local checks. Total 74 demonstrations were conducted and a total area of 26.2 ha was put under CFLD.

Table 1: Comparison between demonstrated package of practices and existing farmer's Practice of Lentil Production in Hathras District.

Sr. No.	Intervention	Demonstrated package	Farmers' practice
1.	Farming situation	Irrigated	Irrigated
2.	Variety	DPL-62 (Sheri) and KLS 218	Local (Unidentified)
3.	Seed treatment	Thirum (2 gm) + Carbendazim (1gm)/kg seed, *Culture:* Rhizobium + PSB, one packet each for 10 kg seed.	Nil
4.	Time of Sowing	10-18.11.2015 23 Nov. to 05 Dec. 2017	10-25 Nov.
5.	Sowing Method	Line sowing at 30 cm L to L	Broadcasting
6.	Irrigation	Pre flowering stage	Nil
7.	Seed rate	50 kg/ha (Bold) and 35kg/ha (Small seeded)	30 kg/ha
8.	Fertilizer dose	DAP @100 kg/ha	Nil
9.	Plant protection	Seed treatment	Nil
10.	Weed management	One hand weeding at 30 DAS	One hand weeding at 35-40 DAS
11.	Harvesting time	18-25 march, 2016 20-25 march, 2018	15-20 March

All standard packages of practices were applied in demonstration plots (Table no. 1). The farmers were provided with DPL-62 (Sheri) and KLS 218 lentil seed @ 20 kg. The input for famers practice was arranged by farmers themselves during both the years. The seed of new varieties DPL-62 (Sheri) and KLS 218 was purchased from NSC, Agra and C. S. A. University of Agriculture and Technology, Kanpur and made available to farmers. The soil of each demonstration plot was tested for pH, EC, O. C. and macro nutrients N, P and K. The Recommended dose of fertilizer (100 kg DAP/ ha) in every demonstration was applied on soil test basis. The soil of all demonstration plots was sandy loam and it was low in nitrogen and phosphorus and medium in potash. The pH was reported in the range of 7.2 to 8.5. The whole amount of Di Ammonium Phosphate was applied at sowing time as basal application. Sowing was done on 10 - 18 November during 2015-16 and 23 November to 05 December during 2017-18. The 50 kg/ha treated seed was used in sowing keeping 30 cm row spacing with seed drill. Farmers do the sowing with broadcasting method. The rainfall during the crop growth period was only 27.1 and 20 mm during 2015-16 and 2017-18 mm. However, one irrigation at pre-flowering stage was applied to demonstrations plots. Farmers usually do not go for any irrigation in lentil crop. No disease and insect incidence occurred in crop. The crop was harvested manually at physiological maturity in third week of March (128 and117 DAS during 2015-16 and 2017-18, respectively). However, the plots of farmers practice were matured and harvested about one week later than demonstrations during both the years. The cost of cultivation was calculated on the basis of local rate of inputs and other operation prevailing at that time, similarly the local sale price of lentil was considered for calculation of gross and net income. Grain and biological yields data were recorded by crop cutting method of yield estimation from three demonstrations plots randomly selected from each cluster/ village. After three days sun-drying in the field, the total biomass (grain + straw) was weighed and threshed. Grain yield was reported at 14% moisture content. The total biomass on a dry weight basis was considered as biological yield. Frequent visit of all clusters was made by

scientists of Krishi Vigyan Kendra, Hathras. Field day was also conducted at demonstration plot at harvesting stage of the crop.

Results and Discussion

Grain Yield

The data pertaining to performance of lentil crop in both demonstration and farmers practice is given in table 2. It is evident from the table that grain yield, biological yield and harvest index of both the demonstrated varieties grown with recommended package of practices was higher than the local variety used by most of the farmers of Hathras district. The maximum grain yield (9.85 q/ha) was obtained from variety KLS 218 which was 39.71% higher than the yield of farmers practice. This was followed by DPL 62 which gave 9.42 q/ha with an increment of 36.52% over farmers practice. It is clear from the data shown in the table 2 that the highest commercial yield, was obtained due to varietal intervention grown with recommended package of practices. Kundu *et al.* (2014) [11] also ob-served significant differences in yield of the 16 lentil crop variety. It was the combined impact of new varieties and starter dose along with culture treatment. This might be due to the proper supply of phosphorus (Starter dose) to the crops which play important role in a number of metabolic functions and is especially important for grain formation (Balyan and Singh 2005) [4]. It is needed in relatively large amounts by legumes for growth and nitrogen fixation, and it was found to increase biomass, yield, nodulation, and nutritional quality in lentils (Yemane and Skjelvag, 2003) [20]. For higher and sustainable lentil yield in vertisols, application of 20 kg P/ ha has been recommended earlier by Zike *et al*. (2017) [21]. Moreover, Singh *et al*. (2011) [18] have also suggested that the application of nitrogen and phosphorus is essential for obtaining high grain yields of lentil. Sarker *et al* have suggested that unavailability of the tested site specific lentil cultivars and imbalanced use of fertilizers are contributing factors towards the lower lentil yields at the farm level below the genetic potential of its cultivars. Most of the soils under demonstration are low-to-medium in available phosphorus, therefore they respond positively to P-fertilizer application (Hojjat and Taherzadeh, 2013) [9]. The phosphorus efficient genotypes would be helpful to get the highest response from lower-P soils.

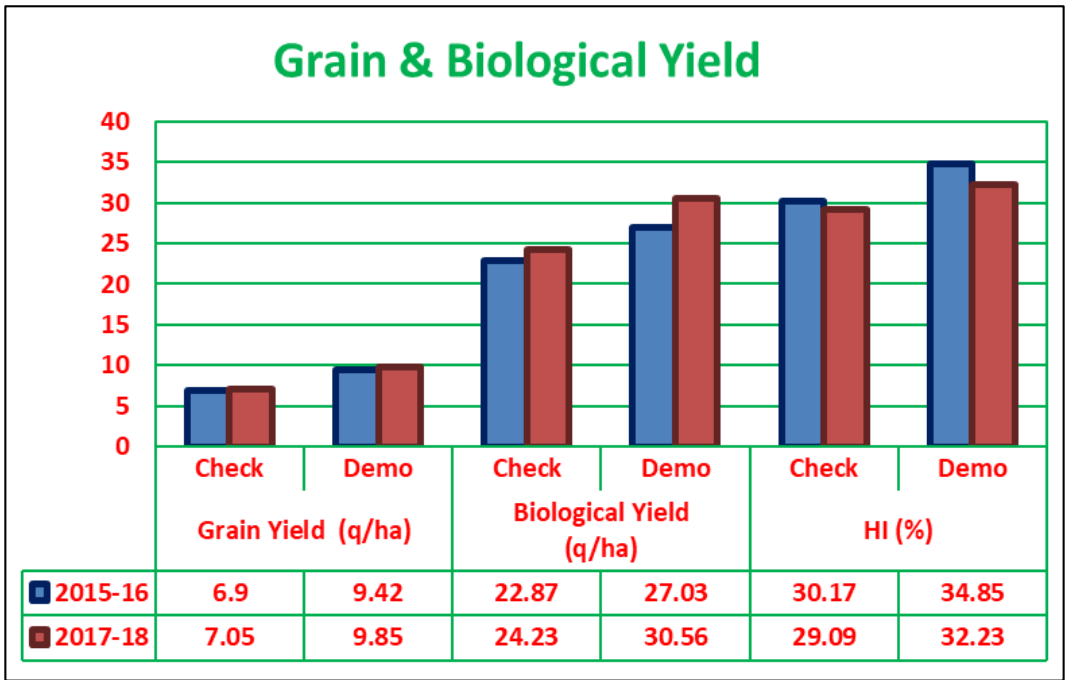

Fig 1: Grain Yield, Biological Yield and Harvest Index of Lentil

Table 2: Grain Yield of Lentil obtained under demonstration v/s farmer's practice

Year	Grain Yield obtained (q/ha)						Yield increase (%)
	Check (Local variety + Farmer's POP)			Demo (DPL-62/KLS-218+Recommended POP)			
	Max.	Min.	Av.	Max.	Min.	Av.	
2015-16	9.34	6.20	6.90	12.7	6.87	9.42	36.52
2017-18	10.20	5.40	7.05	13.90	6.95	9.85	39.71
Mean	9.77	5.8	6.97	13.3	6.91	9.63	38.11

Biological Yield and Harvest Index

It is evident from the data that application of starter dose in combination with high yielding varieties enhanced the Biological Yield over farmers practice. The highest Biological yield of 30.56 q/ha and 27.03 q/ha was obtained from DPL -62 and KLS -218 variety during 2017-18 and 2015-16 respectively. The higher biological yield may be attributed to higher level phosphorus fertilization which increases the dry matter accumulation as phosphorus is directly involved in a number of metabolic functions and is especially important for grain formation (Balyan and Singh 2005) [4]. The higher biological yield of lentil with the application of starter dose (P) might be due to the increasing availability of soil nutrients and their uptake by plants, which resulted in higher dry matter accumulation in leaves and stem at earlier growth stages and better translocation to seed during later stages. Nkaa *et al*. (2014) [13] also reported the similar effect of applied phosphorus on dry matter accumulation. These results

indicate that nutrients is playing a role in metabolism, chlorophyll formation and photosynthesis activities of the plant and all these resulted in increased biological yield (Fageria, (2009) [7].

- In present study the data of mean comparison suggested that the highest harvest index (34.85%) was from the variety DPL – 62 during the year 2015-16, although it did not show much difference with other cultivars of KLS – 218 (32.23%), Local (30.17 during 2015-16 and 29.09% during 2017-18) and and they were in one level (Table 3). Also, the cultivar of local had the lowest harvest index. This result agreed with Hussain *et al*. (2002) [10] and Shah *et al*. (2000) [17] who reported significantly differed harvest index from different cultivars. Increased mean harvest index of lentil was obtained with application of starter dose. This result was in consistence with Chiezey *et al*. (1992) [5] who reported that lower harvest index at low level of phosphorus application might be due to poor development of plants at different growth stages.

Economics

The cost of cultivation for both the demonstrated varieties of lentil grown with recommended package of practices recorded higher than the farmer's practice and it was Rs. 18100/ha and Rs.19800/ha during the years 2015-16 and 2017-18 respectively. This difference in cost of cultivation was due to seed and fertilizer cost applied in recommended package of practice. Both of the demonstrated varieties of lentil grown with recommended package of practices showed beneficial effect on grain, biological yield as well as economics as compared to no farmers practice (Table-4). Maximum and higher gross return (Rs. 64025/ha) and, net return (Rs. 43725/ha)) was fetched during 2017-18 under the variety KLS-218 grown with recommended package of practices. However, the maximum B: C ratio was registered with the variety DPL -62 during 2015-16 grown with recommended package of practices. This was due to the increased net return in corresponding to the cost of cultivation. Similar results of yield increment, irrespective of varieties with maximum net return due to application of 20 kg P ha-1 have also been reported earlier by Zike *et al*. (2017) [21].

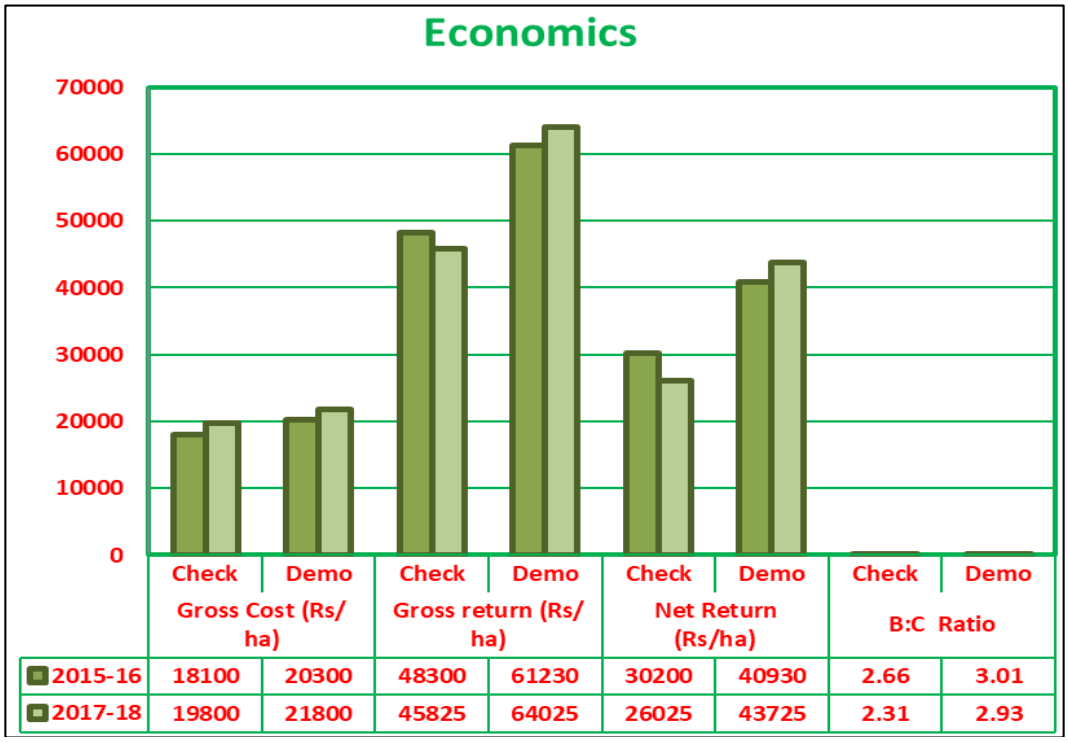

Fig 2: Economics of Lentil in Demo and Farmers Practices

Table 3: Grain Yield, Biological yield and Harvest Index of Lentil obtained under demonstration v/s farmer's practice.

Year	Check (Local variety + Farmer's POP)			Demo (DPL-62/KLS-218+Recommended POP)		
	Grain Yield (q/ha)	Biological Yield (q/ha)	HI (%)	Grain Yield (q/ha)	Biological Yield (q/ha)	HI (%)
2015-16	6.90	22.87	30.17	9.42	27.03	34.85
2017-18	7.05	24.23	29.09	9.85	30.56	32.23
Mean	6.97	23.55	29.59	9.63	28.79	33.45

Table 4: Economics of demonstration and farmer's practice

Year	Expenditure and returns (Rs./ha)								Net returns increase (%)	Increase Return (Rs/Rs)
	Check (Local variety + Farmer's POP)				Demo (DPL-62/KLS-218+Recommended POP)					
	Gross Cost (Rs/ ha)	Gross return (Rs/ ha)	Net Return (Rs/ha)	B:C ratio	Gross Cost (Rs/ ha)	Gross return (Rs/ ha)	Net Return (Rs/ha)	B:C ratio		
15-16	18100	48300*	30200	2.66	20300	61230	40930	3.01	35.52	5.87
17-18	19800	45825**	26025	2.31	21800	64025	43725	2.93	68.01	9.10
Mean	18950	47062	28112	2.448	21050	62627	42327	2.97	51.76	7.48

*Sale Price 2015-16 Local check- @Rs.7000/q Demo-@ Rs. 6500/q

**Sale Price 2017-18 Local check- @Rs.6500/q Demo-@ Rs. 6500/q

The net returns under the variety KLS-218 (Rs. 43725/ha) and variety DPL-662 (Rs. 40970/ha was increased by 68.01 and 35.52 per cent, respectively, over the farmer's practice. A return of Rs. 9.10 and Rs. 5.87 was recorded for every additional Rupee invested on seed of HYV and fertilizer.

Conclusion

On the basis of results of Cluster Front Line Demonstrations conducted during two consecutive years, It was concluded that for obtaining higher grain yield, straw yield, gross and net income with higher B: C ratio from Lentil, variety KLS-218 may be adopted with recommended package of Practice under Hathras conditions of Uttar Pradesh. It would help the farmers in increasing the farm income with additional benefit of improving soil health.

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References

1. Anonymous. Feeling The Pulse: Towards Better Self-Sufficiency In Pulses In India. ICRISAT Happening News Letter, 2018I.
2. Anonymous. Pulses Revolution- From Food to Nutritional Security. Crops Division, Government of India Ministry of Agriculture & Farmers Welfare Department of Agriculture, Cooperation & Farmers Welfare, Krishi Bhavan, New Delhi – 110001. 2018II
3. Anonymous. Agricultural Statistics, Government of India Ministry of Agriculture &, 2019.
4. Balyan JK, Singh M. Effect of seed inoculation, different levels of irrigation and phosphorus on nodulation and root growth development of lentil. Research on Crops. 2005; 6:323.
5. Chiezey UF, Yayock J, Shebayan AY. Response of soybean to N and P fertilizer levels. Journal of Tropical Science Zaria. 1992; 32:361-368.
6. Dhuppar P, Biyan S, Chintapalli B, Rao S. Lentil Crop Production in the Context of Climate Change: An Appraisal. Indian Research Journal of Extension Education. 2012; 2:33-35.
7. Fageria NK. The use of nutrients in crop plants. CRC Press, USA, 2009, 430.
8. Farmers Welfare Department of Agriculture, Cooperation & Farmers Welfare Directorate of Economics & Statistics New Delhi.
9. Hojjat SS, Taherzadeh A. Effect of integrated application of a complex fertilizer (N30P50) on nitrogen fixation by Lentil (*Lens culinaris* Medik.). International Journal of Agriculture and Crop Sciences. 2013; 5:896-899.
10. Hussain M, Shah SH, Nazir MS. Differential genotypic response to phosphorus application in lentil (*Lens culinaris* M.). Pakistan Journal of Agricultural Sciences 2002; 39:193-196.
11. Kundu MK, Maji S, Basu S, Nath R, Chakraborty PK. Evaluation of pre-released bold seeded lentil varieties for growth and yield potential in the Gan-getic plains of West Bengal. J Crop and Weed. 2014; 10(2):111-117.
12. Nasim Ahmad, Sinha DK, Singh KM. Economic Analysis of Production and Instability of Lentil in Major Lentil Growing States of India. Int. J Pure App. Biosci. 2018; 6(1):593-598.
13. Nkaa FA, Nwokeocha OW, Ihuoma O. Effect of Phosphorus fertilizer on growth and yield of cowpea (*Vigna unguiculata*). IOSR Journal of Pharmacy and Biological Sciences. 2014; 9:74-82.
14. Production Technologies in Central Plain Zone of Uttar Pradesh. J Krishi Vigyan. 2019; 7(2):248-250.
15. Rai D, Singh V, Singh VN, Ramkewal. Technological Gap in Adoption of Pulse, 2019
16. Sarker A, Erskine W, Baker MA, Rahman MM, Yadav NK. Role of lentil in human nutrition and crop diversification in Asia region. In: Gowda CLL, Pande S (eds.). Role of Legumes in Crop Diversification and Poverty Reduction in Asia. CLAN Steering Committee Meeting, 2004.
17. Shah NH, Hafeez FY, Arshad M, Malik KA. Response of lentil to *Rhizobium leguminosarum* bv. viciae strains at different levels of nitrogen and phosphorus. Australian Journal of Experimental Agriculture. 2000; 40:93-98.
18. Singh G, Hari Ram, Sekhon HS, Aggarwal N, Khanna V. Effect of Nutrient Management on Nodulation, Growth and Yield of Lentil (*Lens culinaris* Medik.) Genotypes. American-Eurasian Journal of Agronomy, 2011; 4(3):46-49.
19. Tiwari AK, Shivhare AK. Pulses in India: Retrospect and Prospects. Government of India Ministry of Agriculture & Farmers Welfare (Department Of Agriculture, Cooperation and Farmers Welfare) Directorate of Pulses Development Vindhyachal Bhavan Bhopal (M.P.) 462004. DPD 2016; 1(2).
20. Yemane A, Skjelvag AO. Effects of Fertilizer Phosphorus on Yield Traits of Dekoko (*Pisum sativum* var. *abyssinicum*) Under Field Conditions. Journal of Agronomy and Crop Science, 2003; 189:14-20.
21. Zike T, Abera T, Hamza I. Response of Improved Lentil (*Lens culinaris* Medik) Varieties to Phosphorus Nutrition on Vertisols of West Showa, Central Highlands of Ethiopia. Adv Crop Sci Tech. 2017; 5(6):315.