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Effect of different spacing and varieties on growth and yield of lentil

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ABSTRACT

Different varities and plant populations influences various physiological and biological activities in lentil. The present study aimed to productivity and probability of lentil affected by different varieties and plant population. An agronomic investigation was carried out at Department of Agronomy, R.A.K. College of Agriculture, Sehore, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh during *Rabi* 2020-21. The experiment laid down in a factorial randomized block design (FRBD) with three replications. The experiments consist of eight treatments combinations, *i.e*. for main factor four varieties RVL31, RVL11-6, RVL13-7, RVL13-5 and sub factor three population density 2.2, 3.3, 4.4, Lakh/ha. Lentil variety RVL13-7 with 3.3 lac/ha recorded significantly higher growth attributes and yield *viz*, plant height (cm), number of branches/plant, number of nodules/plants, weight of dry nodule/plant (mg), seed index (g) and yield over control. Thus, we can recommend lentil variety RVL13-7 with 3.3 lac/ha to the farmers in Eastern part of Vindhyan Plateau in sub-tropical zone of Madhya Pradesh in a sustainable way.

Key words: *Lentil, Spacing, Varieties and yield*

Introduction

The Lentil *(Lens culinaris* M.*)* is an important cool season grain legume crop in India, which is second major winter sown legume after chickpea. Lentil belongs to the sub-family Papilionaceae under the family Fabaceae (Leguminosae), crop origin is the near east and Egypt at the Central and Southern Europe, the Mediterranean basin, Ethiopia, Afghanistan, India (Cubero,1981). Lentil is an annual plant known for its lens-shaped seed. The seeds grow in pod usually with two seeds in each. Lentil is a valuable human food, mostly consumed as dry seed (whole decorticated, seed decorticated and spilt) and also use in flatbread, vegan and sprouted seed. Lentil seeds contain 1-2% fat, 24–32% proteins and minerals (iron, cobalt and iodine) and vitamins. Lentil straw is also a valued animal feed due to low cellulose- containing. Lentil is one of the less selective legumes in terms of climate and soil features. It can be grown to a altitude of 3000 meters. On the other hand the seed yield per area decreases when the altitude increases (Whyte *et al.*, 1953). Lentil is a well-adapted plant that grows in a wide range of soil types. However, the heavy textured soils causes yield reduction, whereas sandy-loam soils are the most suitable for lentil growth (Sehirali, 1988; Ozdemir, 2002). Lentil is a winter crop usually grown in fall and harvested in summer and some varieties can also be sown in spring. However, late sowing will decrease yield and increase protein content (Sehirali, 1988). Freezing temperatures below -25 ºC damage the plants (Ozdemir, 2002) so that lentil should not be cultivated at very low tempera-

tures. It is reported that lentil can fix 46-192 kg N per ha. However, in order to encourage the bacterial activity, the application of 1 kg/ha of nitrogen and 2.5 kg/ha of phosphorus is recommended during the growing season, and fertilizer application should be passed on soil analysis (Cokkizgin *et al*., 2005). Weed control is an important agricultural practice that affect seed yield. Yenish *et al*. (2009) reported that weeds may reduce lentil yield by 20-80%. The important lentil-growing countries of the world are India, Canada, Turkey, Bangladesh, Iran, China, Nepal and Syria. Indian production of lentil crop is 1.56 milion tones & productivity 1139 kg/ha & area 1.51 (Anonymous 2019) .Major lentil growing states like Madhya Pradesh, Bihar and West Bengal. Relatively larger share of lentil production was observed in Madhya Pradesh (30.94%),followed by Uttar Pradesh (28.72%).In Madhya Pradesh it's grown on an 0.56 million ha with the production of 0.64 million tone (Anonymous 2019). Too low and high plant population beyond a certain limit often adversely affects the crop yield. Number of plants per unit area influences plant size, yield components and ultimately the seed yield (Beec and Leach 1989). Optimum plant population density is an important factor to realize the potential yields as it directly affects plant growth and development. The plants are able to fill available space by initiating lateral branches and thus, can compensate for poor emergence and thin stands (Morrison and Muehlbauer, 1986). Optimum spacing can ensure proper growth of the aerial and underground parts of the plant through efficient utilization of solar radiation, nutrients, water, land as well as air spaces. Spacing for line sowing is recommended to maintain the required number of plant population and to undertake intercultural operations for harvesting a higher yield. Seed rate has a major bearing on the yielding ability of any crop. Optimum plant population density is an important factor to realize the potential yields as it directly affects plant growth and development where the plants are widely spaced, biological yields tend to increase linearly with increase in plant density due to no or minimum competition between the adjoining plants and also the higher leaf area index and greater absorption of solar radiation. Generally, grain yield was tending to decreasing with increasing sowing rates. Number of pods/plant, an important primary yield component, is the more unsteady attribute among yield components of legumes. Number of pods/plant, was affected significantly by different row spacing and seeding rate and their interaction. Many new varieties developed for higher yield potential so there is need to find out optimum plant population for those varieties for higher production. Thus, the present study Effect of different spacing and varieties on growth and yield of lentil (*Lens culinaris* M.)" is proposed to laid out in during *Rabi* season 2020-21.

Materials and Methods

A field investigation was conducted during *rabi* season 2020-21 on area having fairly uniform topography, normal fertility status and soil homogeneity at Department of Agronomy, R.A.K. college of Agriculture, Sehore, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, which is situated Eastern part of Vindhyan Plateau in sub-tropical zone at the latitude of 23^0 12′ North and longitude of 77^0 05′ East at an altitude of 498.77 m from mean sea level (MSL) in Madhya Pradesh. Fig. 1 shows weather parameters during crop season. The experiment laid down in a factorial randomized bloc design (FRBD) with three replications. The experiments consists of eight treatments combi-

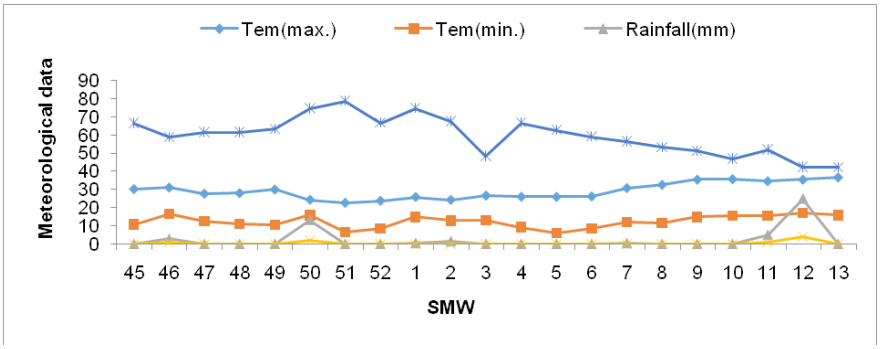

Fig. 1. Shows weather parameters during experimentation.

nations *i.e*. for main factor four varieties RVL31, RVL11-6, RVL13-7, RVL13-5 and sub factor three population density 2.2, 3.3, 4.4, Lakh/ha. Sowing dates of was 16 November 2020. General recommended dose of nutrients were applied through urea and single super phosphate. Complete dose of nitrogen and phosphorus were applied as a basal application. All the recommended package of practices of the zone were followed for growing the crop except varieties and population density. To maintain the healthy crop stand gap-filling at 10 days after sowing (DAS) and thinning at 15 DAS was done in lentil. Lentil harvested at its physiological maturity stage. Pods of each net plot on complete drying were threshed manually and finally winnowed to separate the chaff from the seeds plot wise during both the seasons.

***Analyses of plant growth, yield attributes and yield*:** The observations on number of nodules/plant, plant height (cm), number of branches/plant, number of pods/plant and number of seeds/pod were recorded manually by randomly selecting five representative plants from each plot of each replication. Yield and yield attributes were also recorded. Harvesting was carried out on 9 March 2021. The seed and straw yield was recorded from net plot area of each treatment.

***Statistical analysis*:** The data recorded for different parameters were analysed with the help of two factor analysis of variance (ANOVA) for factorial randomized block design. The treatment differences were compared at 5% level of significance. Comprehensive statistical analysis (treatment mean, standard error mean, critical difference and range of variation) and test of significance test (F-test) were carried out for each trait.

Results

Effect of varieties on growth, yield attributes and yield: In present study, Different types of variety and plant population were significantly increased the growth parameters, yield attributes characters and yield of lentil, *viz* number of nodules/plant, relative growth rate (g/m/day), plant height (cm), number of branches/plant, dry weight (g/plant), dry weight of root nodules/ plant (mg), seed index (g), seed yield (q/ha), straw yield (q/ha) and harvest index (%) during experimental year. Highest root nodules was recorded with variety RVL13-7 (20.37 and 26.71 /plant) respectively 30 and 45 days after sowing over the control. Our results are in closely agreement with the results of Sathyamoorthi *et al*. 2008 who reported that the highest root nodules was obtained from plant population of 3.33 lakh/ha. Number of branches/plant and plant height were significantly increased by variety RVL13-7 over the control (Table 1). The dry weight (g/plant), dry weight of root nodules/ plant (mg), seed index (2.65 g), seed yield (13.02 q/ha), straw yield (27.16 q/ha) and harvest index (31.38 %) of lentil was significantly increased with the variety RVL 13-7 over the control. Our these results are supported by the study of Hamdi *et al*. 2003 who reported that genotype FLIP 95- 68L 32.3 per cent higheryield the control cultivar Giza 9 also increased

Table 1. The growth parameters of lentil as influenced by different varieties and plant population density

Treatments	Root nodules/ plant		Relative growth rate (g/m/day)		Plant height (cm)		Branches/ plant	
	30 DAS	45 DAS	30-45 DAS	45-60 DAS	45 DAS	At harvest	45 DAS	At harvest
Factor A: Varieties								
V_1:RVL31	19.11	23.60	0.13	0.069	17.90	32.77	4.16	13.09
V_2: RVL11-6	19.67	23.78	0.13	0.064	18.16	34.23	4.54	13.67
V_3: RVL13-7	20.37	26.71	0.13	0.063	18.93	34.52	4.96	14.11
V_4: RVL13-5	18.33	22.67	0.13	0.073	17.60	32.10	3.92	12.61
SE(m)±	0.40	0.74	0.05	0.001	0.05	0.15	0.11	0.07
CD at 5%	1.17	2.19	NS	0.003	0.14	0.43	0.34	0.21
Factor B: Population								
P_1:2.2 lac/ha	22.08	29.81	0.13	0.057	16.68	30.24	5.32	15.85
P_2: 3.3 lac/ha	18.83	22.67	0.13	0.068	18.18	33.81	4.26	13.32
P_3: 4.4 lac/ha	17.20	20.08	0.12	0.077	19.61	36.16	3.60	10.94
SE(m)±	0.34	0.64	0.04	0.001	0.05	0.13	0.13	0.06
CD at 5%	1.02	1.90	NS	0.003	0.16	0.37	0.40	0.18

Table 2. The growth parameters, yield attributes traits and seed yield of lentil as influenced by different varieties and plant population density

Treatments	Dry weight g/plant		Dry weight of root nodules/plant (mg)		Seed index (g)	Seed yield (q/ha)	Straw yield/ha (q)	Harvest index (%)
	45 DAS	At harvest	30 DAS	45 DAS				
Factor A: Varieties								
V_1:RVL31	0.70	2.81	25.20	47.65	2.38	11.58	24.95	30.55
V_2: RVL11-6	0.77	2.99	26.32	47.88	2.56	12.26	25.64	31.27
V_3: RVL13-7	0.83	3.17	28.01	51.38	2.65	13.02	27.16	31.38
V_4: RVL13-5	0.63	2.68	24.90	45.42	2.32	09.34	24.52	27.12
SE(m)±	0.01	0.03	0.55	0.67	0.08	0.04	0.20	0.85
CD at 5%	0.04	0.08	1.10	1.99	0.24	0.13	0.60	2.51
Factor B: Population								
P_1:2.2 lac/ha	0.97	3.47	26.32	53.30	2.93	7.38	20.78	26.18
P_2: 3.3 lac/ha	0.71	2.86	25.17	48.48	2.41	17.32	31.70	35.13
P_3: 4.4 lac/ha	0.52	2.40	23.14	42.48	2.10	9.94	24.21	28.93
SE(m)±	0.01	0.02	0.44	0.58	0.07	0.03	0.23	0.74
CD at 5%	0.03	0.07	1.09	1.72	0.21	0.11	0.69	2.18

in harvest index. Similarly Sarkar *et al.,* 2015 reported varity L 4710 superior in terms of seed yield, stalk yield and harvest index. The results of Ileger 2017 also revealed that RVL31 3 significantly higher yield was attributed to significantly higher growth and yield parameters viz., pods/plant (13.65 and 17.20), seeds/pod (1.06 and 1.07) and harvest index (19.25 and 16.39 %) respectively. The variety RVL 13-7 enhances the flower initiation and fruit/seed setting, resulting in increase the productivity of crops.

Effect of plant population density on growth, yield attributes and yield: In our present study, there was significant influence of plant population density on plant growth and yield parameters during experimental year. number of nodules/plant, relative growth rate (g/m/day), plant height (cm), number of branches/plant, dry weight (g/plant), dry weight of root nodules/ plant (mg), seed index (g), seed yield (q/ha), straw yield (q/ha) and harvest index (%) during experimental year were significantly influenced plant population density. Only plant population density 3.3 lakh per ha significantly increased seed yield over the control during mean of experimental year. Ouji *et al.,* 2016 showed that 34 cm row spacing and seed rate of 120 seeds/m^2 was found to be the best for lentil production in terms of biological and grain yields with 2119,2 and 903,9 kg/ha respectively. Similarly Saleem, *et al.,* 2012 also reported that seed yield increased incrementally asseedingrates.

Conclusion

To boost the productivity of lentil need to apply elite variety with optimum plant population. The variety RVL 13-7 with plant population density 3.3 lakh/ha was observed to be more suitable for lentil cultivation in Eastern part of Vindhyan Plateau in subtropical zone of Madhya Pradesh, India.

Conflict of Interest: None

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