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Effect of spent mushroom compost and farm yard manure on growth and yield parameters of lentil (L*ens culinaris* L.)

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Abstract
Lentil species, *L. orientalis*, is thought to be the progenitor of cultivated lentils and is presently designated as *L. culinaris* subspecies Oriental. Lentils are hypogeal, which means that the cotyledons of the germinating seed remain in the soil, and the plant is a diploid, annual, bushy herb with upright, semi-erect, or spreading, compact growth that typically ranges in height from 30 to 50 cm (12 to 20 in). The experiment was carried out to investigate the influence of Spent Mushroom Compost on lentil plant height, number of leaves, and dry matter accumulation. Various levels of spent mushroom compost and farmyard manure were used in the treatments. The results indicated that plant height rose with crop age, with the highest height seen in treatment T4. The number of leaves per plant was maximum with the T_4 treatment. The treatment T4 accumulated the most dry matter. The T5 treatment had the maximum lentil grain yield. Overall, the findings indicate that SMC and FYM can have a considerable impact on lentil plant development and yield.

Keywords: Spent mushroom compost, farm yard manure, lentil

Introduction
Lentil (*Lens culinaris*) is a type of edible legume. It's an annual plant with lenticular seeds. It is around 40 cm (16 in) long, and the seeds grow in pods with two seeds apiece. Canada is the world's largest producer of lentils, making up 45% of total global production. Lentil is known by several different names in different parts of the world. The French botanist Tournefort was the first to use the term lens to denote a specific genus in the 17th century. The term "Lens" for lentil is of classical Roman/Latin origin: A notable Roman family adopted the name "Lentulus", just as a prominent family's name "Cicero" was derived from the chickpea, *Cicer arietinum*, or "Fabia" (as in Quintus Fabius Maximus) from the fava bean (*Vicia faba*). The lens is a tiny genus that includes the farmed *L. culinaris* as well as six similar wild species.

If spent mushroom waste is treated correctly, it can be utilised as a peat substitute in a soilless culture. According to Idowu and Kadiri (2013), SMW is an efficient soil amendment and conditioner, and its use has been shown to significantly improve the production of several crops. Several studies across the world have confirmed that utilising SMW as a growing substrate component improves the production and quality of many vegetables and other horticulture crops.

Material and Methods
The experimental study was carried out at the Agriculture Research Farm, School of Agricultural, Dev Bhoomi Uttarakhand University, and Dehradun which is situated at a distance of about 15 km from Dehradun railway station. Dehradun is located 450 metres above mean sea level at 30^{0}20'20"N latitude and 77^{0}52'33"E longitude. It has a subtropical, rain-fed climate with hot and dry summers from March to June, hot and humid summers from July to September, and freezing winters from November to January. The maximum and minimum temperatures vary greatly over the summer and winter seasons. Summer temperatures exceed 35 °C, but temperatures below 3 °C, accompanied by icy spells, are relatively common during the winter months of December and January. The average annual rainfall in Dehradun is 1896 millimeters, with the majority falling between June and October due to the south-west monsoons.

Experimental Details

Treatments

T_1 @ No Compost
T_2 @ 25% SMC + 75% FYM
T_3 @ 50% SMC + 50% FYM
T_4 @75% SMC + 25% FYM
T_5 @ 100% SMC + 100% FYM
T_6 @ 25% SMC + 25% FYM
T_7 @ 75% SMC + 75% FYM

Results and Discussion

Plant height of Lentil (cm)

Plant height is a key indicator of plant development. It provides a concept for predicting crop growth rate and yield. The analysis of data on periodic plant height revealed a steady increase in plant height with crop age. The results of a rigorous study of the data clearly demonstrated the significant effect of changing SMC dose ration plant height at 30, 60 days after sowing (DAS) and harvest. At the early stages of growth, there was not much variation in plant height across treatments.

Table 4.1: Plant height of Lentil

Lentil crops	Height of Plant (cm)		
Treatments	30 Das	60 Das	At harvest
T_1	11.2	40.23	45.2
T_2	11.6	46.9	51.6
T_3	11.6	41.2	48.4
T_4	16.8	47.8	52.4
T_5	11.8	47.07	51.9
T_6	13.6	44.02	49.2
T_7	12.4	42.02	47.7
S.E(d)	0.89	3.09	3.46
CD (0.05)	0.04	0.15	0.17

Number of leaves in Lentil plant^{-1}

The present data shown in Table 4.3 relevant that the maximum number of leaves 16.06 and 45.6 at 30 DAS and 60 DAS was observed in treatment T4 (75% SMC + 25% FYM) and T3 (50% SMC + 50% FYM) respectively. Which was found statistically at par with 15.2, 14.5, 14.4 and 14.3 at 30 DAS respectively and 45.3 at 60 DAS in treatment.

Table 4.2: Number of leaves in Lentil per plant

Treatments	30 DAS	60 DAS
T_1	9.21	28.2
T_2	11.8	34.3
T_3	14.4	45.6
T_4	16.06	45.3
T_5	14.5	40.8
T_6	15.2	42.9
T_7	14.3	35.7
S.E(d)	0.7	0.11
CD(0.05)	0.95	2.73

Dry matter accumulation plant^{-1} of Lentil

On the perusal data presented in Table 4.3, it is evident that maximum dry matter accumulation plant^{-1} 2.9 g and 12.4 g at 30 DAS and 60 DAS was observed in treatment T3 and found statistically at par with (2.8 g, 2.7 g and 2.5 g, respectively at 30 DAS) and (11.5 g at 60 DAS) in treatment T_4, T_6, T_7 and T_4.

Table 4.3: Dry matter accumulation plant^{-1} of Lentil

Experimental cropping system	Dry weight (g)	
Treatment	30 DAS	60 DAS
T1	2.1	7.7
T2	2.2	8.4
T3	2.9	12.4
T4	2.8	11.5
T5	2.4	9.8
T6	2.7	11
T7	2.5	9.6
S.E(d)	0.18	0.70
CD(0.05)	0.01	0.04

Number of pod plant^{-1}

Number of pods plant^{-1} of lentil was significantly affected by different SMC and FYM doses as shown in Table 4.4. Maximum number of pod plant^{-1} (78) was recorded in treatment T_3, which was statistically at par with treatment T_4. The lowest number of pod plant^{-1} recorded (34.9) in T_1. The minimum number of pods plant^{-1} in Sole Field Pea might be due intra competition from plants.

Number of grain pod^{-1}

The number of grain pod^{-1} of lentil is presented in Table 4.4. Maximum number of grain pod^{-1} (2.6) was recorded in treatment T_3, which was found statistically at par with treatment T_4 1.9 and the minimum number of grain pod^{-1} 0.8 was recorded in treatment T_1.

Table 4.4: No of pod per plant and no of grain per pod in Lentil

Inter cropping system	No. of pod plant^{-1}	No. of grain pod^{-1} (cm)
T1	31.9	0.9
T2	34.9	0.8
T3	78	2.6
T4	69	1.9
T5	67	1.4
T6	62	0.9
T7	65.8	2.06
S.E(d)	4.086	0.1056
CD(0.05)	0.2043	0.00528

Yield and yield attributing characters

Grain yield of Lentil (q ha^{-1})

The present data shown in Table 4.6 relevant that maximum grain yield of Lentil crop 9.4 q/ha was recorded in treatment T_5 (100% SMC + 100% FYM) which was statistically at par with treatment T_3 is about 8.3 and the minimum grain yield of Lentil (3.7 q/ha) was observed in T4 treatment.

Harvest Index (%)

The maximum harvest index (46.9%) is recorded in treatment T_3. The lowest harvest index (38.1%) was recorded in sole Lentil, T_1.

Table 4.5: Lentil yield

Intercropping system	Grain yield (q/ha)	Stover yield (q/ha)	Harvest index (%)
T_1	7.9	14.2	38.1
T_2	6.5	10.3	39.04
T_3	8.3	13.06	46.9
T_4	3.7	4.2	39.1
T_5	9.4	12.1	39.6
T_6	5.9	9.7	39.07
T_7	6.2	10.1	38.03
S.E(d)	0.48	0.74	2.82
CD(0.05)	0.02	0.04	0.14

Conclusion

The present investigation revealed that the Spent Compost of Mushroom proved to be a reliable source of plant nutrient with positive impact on crop. According to the results of present investigation the following conclusion may be drawn.

The SMC and FYM mixed growth environment is expected to successfully support the development of rhizobia, leading in successful nodulation and pod formation. This establish SMC's efficiency as a bio-fertilizer and promoter of Pod formation, as well as its contribution to soil-water holding capacity and nitrogen fixation.

The application of SMC and FYM improved plant height, number of leaves, grain yield, and harvest index significantly.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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