Influence of Spacing and Mulching on Growth and Yield of Black gram (*Vigna mungo* L.) in Prayagraj condition

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Abstract

A field experiment was conducted during Zaid 2021 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36 %), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The experiment was laid out in Randomized Block Design with nine treatments each replicated thrice on the basis of one year experimentation. The treatments which are T_1: 30 cm x 15 cm + No mulch, T_2: 30 cm x 15 cm + Mustard Straw, T_3: 30 cm x 15 cm + Saw dust/ Dry leaves, T_4: 30 cm x 15 cm + Newspaper/ Brown paper, T_5: 45 cm x 10 cm + No mulch, T_6: 45 cm x 10 cm + Mustard Straw, T_7: 45 cm x 10 cm + Saw dust/ Dry leaves, T_8: 45 cm x 10 cm + Newspaper/ Brown paper, T_9: Control plot used. The results showed that 45 cm x 10 cm + Mustard Straw was recorded significantly higher plant height (43.91 cm), nodules/plant (13.27), No. of Branches/plant (6.53), Plant dry weight (6.39 g/plant), pods/plant (65.09), Seeds/pod (7.66), Test weight (37.18 g). However, higher Seed yield (669.33 kg/ha), gross returns (Rs. 73626.3/ha), net return (Rs. 50741.65/ha) and benefit cost ratio (2.21) were obtained under of 30 cm x 15 cm + Mustard Straw as compared to other treatments.

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Key words: Spacing, Mulching, yield.

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INTRODUCTION

Pulses are commonly known as food legumes with are secondary to cereals in production and consumption in India. The United Nations, declared 2016 as “International Year of Pulses” (IYP) to heighten public awareness of the nutritional benefits of pulses as part of sustainable food production aimed at food security and nutrition. Pulses are an integrated part to many diets across the globe and they have great potential to improve human health, conserve our soil, protect the environment and contribute to global food security

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Black gram (Vigna Mungo) is one of important pulse crop. The food legumes, particularly the grain or pulses are important food stuff in all tropical and subtropical countries **(Malik *et al.*, 2007).** It is grown throughout India. Black gram is widely grown grain legume

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and belongs to the family “Leguminosae” and genus “Vigna” and assumes considerable importance from the point of food and nutritional security in the world. It is also known as urd bean, urad dal or urad. It also acts as cover crop and its deep root system protects the soil from erosion. The crop also improves soil fertility by symbiotic fixation of atmospheric nitrogen in root nodules.

Black gram is grown well in moisture retentive light soil, but loamy and clay loam are suitable for the cultivation of Black gram. Loams to clay loam with neutral pH are best suited for Black gram cultivation. It is susceptible to waterlogged conditions of the soil. It defers from other pulses in its peculiarity of attaining a somewhat mucilaginous pasty character, giving additional body to the mass due to long polymer chain of polysaccharide chain of carbohydrates. Tamil Nadu leads first in productivity with an average yield of 775 kg/ha. It contained 24.7 % protein, 0.6 % fat, 0.9 % fibre and 3.7 % ash as well as sufficient quantity of calcium, phosphorus and important vitamins. Due to cheaper protein source it is designated as “poor man’s meat” **(Aslam *et al.*, 2010).**

The pulses are grown on 304 lakh ha are in India with production of 14.77 million tones with a productivity of 617 kg/ha. The total area under pulses in Tamil Nadu is 8.32 lakh ha with total production of 3.67 lakh tones and productivity of 441 kg/ha. In Tamil Nadu black gram occupies an area of 2.0 lakh ha with total production of 425 kg/ha. The average yield obtained at farmers field is low, because no systematic efforts have been made in the past to develop a package of technology, which may ensure high seed yield of this crop. Important reasons for low average yield of black gram at farmers field were the continuous cultivation of traditional low potential cultivars, use of low seed rate and improper agronomic practices **(P Veeramani, 2019).**

Plant density can have a major effect on the final yield of most of the legumes and the general response of yield to increasing population is well documented. To realize the maximum yield potential of black gram during summer and rainy season, maintenance of optimum space made available to individual plant is of prime importance. Row and plant spacing has to be worked out to get desired spacing. The spacing requirement depends upon the growth behaviour of genotype. So it is required to maintain spacing for obtaining higher yield **(Veeramani, 2019).**

Abiotic and biotic factors can be overcome by application of mulches and organic manures. Mulches were effective in controlling weeds and also conserving in-situ moisture **(Uwah and Iwo, 2011).** Soil organic matter and moisture was found to improve under mulching. Thus, mulching serves as one of the best alternatives to manage both the abiotic and biotic factors like rainfall, soil temperature, weeds, etc. which results in good crop establishment and increase the water use efficiency. Mulching reduces the deterioration of soil, minimizes the weed infestation and checks the water evaporation. Thus, it facilitates more retention of soil moisture and helps in control of temperature fluctuations, improves physical, chemical and biological properties of soil. As it adds nutrients to the soil and ultimately enhances the growth and yield of crops **(Komal *et al.*, 2018).**

MATERIALS AND METHODS

This experimental trial was carried out during Zaid 2021 at Crop Research Farm (CRF), Department of Agronomy, Sam Higginbottom University of Agriculture, Technology & Sciences (SHUATS), Prayagraj (U. P) located at 25˚39”42” North latitude, 81˚67”56” East longitude and 98 m altitude above the mean sea level. The experiment laid out in Randomized Block Design consisting of nine treatments which T_1: 30 cm x 15 cm + No mulch, T_2: 30 cm x 15 cm + Mustard Straw, T_3: 30 cm x 15 cm + Saw dust/ Dry leaves, T_4: 30 cm x 15 cm + Newspaper/ Brown paper, T_5: 45 cm x 10 cm + No mulch, T_6: 45 cm x 10 cm + Mustard Straw, T_7: 45 cm x 10 cm + Saw dust/ Dry leaves, T_8: 45 cm x 10 cm + Newspaper/ Brown paper, T_9: Control plot replicated thrice to determine the effect of Spacing and Mulching on Growth and Yield of Black gram. The soil of trial plot was sandy loam in texture nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36%), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The nutrient sources used in the research plot were urea, DAP and MOP to fulfill the requirements of nitrogen, phosphorous and potassium. The recommended dose of 20kg of N/ha, 40 kg P/ha and 20 kg K/ha were applied. Spacing was maintained as per the treatment combination and also mulching was applied in each plot except control as per the treatment combinations. Several plant growth parameters were recorded at harvest and several yield parameters were recorded after harvest. In growth parameters plant height (cm), number of branches/plant, number of nodules/plant, plant dry weight (g) and

number of branches/plant were recorded and yield parameters like number of number of pods/plant, number of seeds/plant, test weight (g) and seed yield (kg/ha) were recorded and statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized Block Design (Gomez, K. A. and Gomez, A. A. 1984).

RESULTS AND DISCUSSION

Effect on growth of Black gram

The statistical data regarding growth parameters is presented in Table 1.

Plant height (cm)

significantly highest plant height (43.91 cm) was observed in the treatment with 45 cm x 10 cm + Mustard Straw over all the other treatments. However, the treatment with application of 45 cm x 10 cm + Saw dust/ Dry leaves (43.63 cm) was found to be statistically at par with treatment 45 cm x 10 cm + Mustard Straw as compared to all the treatments. The spacing practices had significant effects on plant height (cm); however, an increasing trend with optimum geometry level could be noticed. This may be due to the competition between the inter and intra plants for sun light, water, nutrients and space at closer spacing, whereas optimum spacing helped in significantly highest plant height. Significant results were obtained due to the optimum spacing of 30x10 cm and similar results were obtained by **Singh *et al.* (2009).** It is obvious that mulching leads to better plant growth by changing the micro-climate by conserving more moisture through reducing evaporation, modifying soil temperature, controlling weeds and thus economizing the use of soil water. This helped in the deep root penetration and higher plant height. The results were in accordance with **Verma *et al.* (2008).**

Plant dry weight (g)

Treatment with 45 cm x 10 cm + Mustard Straw was recorded with significantly maximum dry weight (6.39 g/plant) over all the treatments. However, the treatments with 45 cm x 10 cm + Saw dust/ Dry leaves (6.34 g/plant) and 45 cm x 10 cm + Newspaper/ Brown paper (6.24 g/plant) were found to be statistically at par with 45 cm x 10 cm + Mustard Straw. Higher dry matter production is observed in 45x10 cm spacing due to better photosynthetic activity due to greater exposure to light and increased availability of nutrients to plants have

also resulted in higher dry weight, the treatment showed the increasing trend in dry weight up to harvest stage, **Gadade *et al*. (2018)** also reported similar results. Due to mulching there was adequate presence of moisture to plants results in full cell turgidity and eventually higher meristematic activity, leading to more foliage development, greater photosynthetic rate and consequently better plant growth rate and higher biomass accumulation. The results were found to be in resonance with **Anand *et al.* (2020).**

Nodules/Plant

Significantly highest nodules per plant (13.27) were observed under the treatment 45 cm x 10 cm + Mustard Straw, which was significantly higher over rest of the treatments. However, the treatments with 45 cm x 10 cm + Saw dust/ Dry leaves (12.90) and 45 cm x 10 cm + Newspaper/ Brown paper (12.43) were found to be statistically at par with 45 cm x 10 cm + Mustard Straw. The optimum spacing resulted in increase of nodulation, root growth and growth the growth which might be due to higher number of nodules might have supplied sufficient nitrogen by fixation, the results were similar to **Tanya *et al.* (2015)**. Mulching leads to higher water conservation and which leads to root development and higher meristematic tissue activity and mulch creates an impervious layer on the soil surface and break continuity of capillary pores which helps in reducing evaporative loss of water. Mulch also reduces run off loss of water, increases rate of infiltration, reduces growth of weeds and helps in providing proper aeration to the roots and higher nodules formation. The results were found to be similar with **Dukare *et al.* (2017)**.

No. of Branches/Plant

Significantly higher number of Branches per plant (6.53) was observed under the treatment 45 cm x 10 cm + Mustard Straw. However, the treatments with 45 cm x 10 cm + Saw dust/ Dry leaves (6.43) and 45 cm x 10 cm + Newspaper/ Brown paper (6.26) which were found to be statistically at par with 45 cm x 10 cm + Mustard Straw. The optimum (increased) plant spacing between plants resulted in enhanced space, sun-light, nutrients and soil moisture for increased photosynthesis, metabolic activities, growth and development which resulted in higher number of branches. The results were in accordance with **Amruta *et al*. (2015)**. Due to mulching there was adequate presence of moisture to plants results in full cell turgidity and eventually higher meristematic activity, leading to more foliage development, greater

photosynthetic rate and consequently better plant growth rate and higher biomass accumulation. The results were found to be in resonance with **Anand *et al.* (2020).**

Table 1: Influence of Spacing and Mulching on growth parameters of Black gram.

Treatments	Plant height (cm)	Plant dry weight (g)	Nodules/Plant	Number of branches/plant
1. 30 cm x 15 cm + No mulch	41.15	5.37	9.77	5.52
2. 30 cm x 15 cm + Mustard Straw	42.90	5.99	11.90	6.13
3. 30 cm x 15 cm + Saw dust/ Dry leaves	42.21	5.85	11.40	5.92
4. 30 cm x 15 cm + Newspaper/ Brown paper	41.91	5.76	10.80	5.68
5. 45 cm x 10 cm + No mulch	41.58	5.58	10.27	5.60
6. 45 cm x 10 cm + Mustard Straw	43.91	6.39	13.27	6.53
7. 45 cm x 10 cm + Saw dust/ Dry leaves	43.63	6.34	12.90	6.43
8. 45 cm x 10 cm + Newspaper/ Brown paper	43.19	6.24	12.43	6.26
9. Control plot	40.89	5.13	9.30	5.29
S. EM (±)	0.28	0.05	0.31	0.11
CD (5%)	0.82	0.15	0.93	0.32

Effect on yield and yield attributes of Black gram

The statistical data representing yield and yield attributes is presented in Table 2.

Pods/Plant

Significantly Maximum Pods/plant (65.09) was recorded with the treatment of application of 45 cm x 10 cm + Mustard Straw over all the treatments. However, the treatments 45 cm x 10 cm + Saw dust/ Dry leaves (64.59) and 45 cm x 10 cm + Newspaper/ Brown paper (63.88) which were found to be statistically at par with 45 cm x 10 cm + Mustard Straw. Higher number of pods/plant might have been possible due to more vigour and strength attained by the plants as a result of better photosynthetic activities with sufficient availability of light, and supply of nutrients in balanced quantity of the plants at growing stages, **Jitendrakumar *et al.* (2015)** observed the similar results. The superiority of mulches over control could be assigned to their effectiveness in reducing the evaporation losses by creating obstacle in external evaporativity and energy supply to evaporating site by cutting of solar radiation falling on the earth surface. It seems that moderate hydrothermal regimes under different mulch materials may have resulted better plant development. Thus, the improvement in yield attributes of blackgram. The results were found to be similar with **Bochliya *et al.* (2020)**

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Seeds/Pod

Significantly higher Seeds/Pod (7.66 cm) were recorded with the treatment 45 cm x 10 cm + Mustard Straw over all the treatments. However, the treatments 45 cm x 10 cm + Saw dust/ Dry leaves (7.56 cm) and 45 cm x 10 cm + Newspaper/ Brown paper (7.43 cm) which were found to be statistically at par with 45 cm x 10 cm + Mustard Straw. Increase in the number of seeds/pod under mustard straw mulch is due to the fact that it adds nutrients to soil though decomposition of stover and leads to better moisture availability by reducing the water loss through evaporation and by suppressing weed growth by depriving the germinating weeds, which effected on the yield attributes of black gram. The results were in accordance with **Mahale *et al.* (2018)**

Test weight (g)

Significantly highest Test weight (37.18 g) was recorded with the treatment of 45 cm x 10 cm + Mustard Straw over all the treatments. However, the treatments with (36.81 g) in 45 cm x 10 cm + Saw dust/ Dry leaves and (36.38 g) in 45 cm x 10 cm + Newspaper/ Brown paper

which were found to be statistically at par with 45 cm x 10 cm + Mustard Straw. Better availability of moisture and moderation of soil temperature which led to greater uptake of nutrients and reduced number of days taken to meet the required heat units for proper growth and development of plants and ultimately the yield attributes. The results were recorded similar with **Anand *et al.* (2020)**

Seed yield (kg/ha)

Significantly highest Seed yield (669.33 kg/ha) was recorded with the treatment application of 30 cm x 15 cm + Mustard Straw over all the treatments. However, the treatments with (656.53 kg/ha) in 30 cm x 15 cm + Saw dust/ Dry leaves, (645.50 kg/ha) in 30 cm x 15 cm + Newspaper/ Brown paper and (652.57 kg/ha) in 45 cm x 10 cm + Mustard Straw which were found to be statistically at par with 30 cm x 15 cm + Mustard Straw. The optimum spacing 30x15 cm helped plant to receive sufficient amount of heat, water and nutrients from soil which increased number of pods/plant, seeds/pod and test weight which directly helped in increase of seed yield in lentil. The results were similar to **Singh *et al*. (2009).** The beneficial effect of mulch on seed yield might be due to favourable soil moisture regime and its better utilization in production of large number of seeds possibly by reducing floral abortion, maintenance of a steady flux of assimilates during grain filling, reducing the rate of leaf senescence and maintenance of photosynthetic activity of surviving leaves and enhanced remobilization of pre anthesis assimilates to seed during seed filling which helped in higher seed yield, **Bochliya *et al.* (2020).**

Table 2: Influence of Spacing and Mulching on Yield attributes and Yield of Black gram.

	Treatments	Pods/Plant	Seeds/Pod	Test weight (g)	Seed yield (Kg/ha)
1.	30 cm x 15 cm + No mulch	59.86	6.38	33.82	577.00
2.	30 cm x 15 cm + Mustard Straw	62.97	7.18	35.70	669.33
3.	30 cm x 15 cm + Saw dust/ Dry leaves	62.05	7.04	35.21	656.53
4.	30 cm x 15 cm + Newspaper/ Brown paper	61.47	6.94	34.63	645.50
5.	45 cm x 10 cm + No mulch	60.74	6.59	34.34	563.23
6.	45 cm x 10 cm + Mustard Straw	65.09	7.66	37.18	652.57
7.	45 cm x 10 cm + Saw dust/ Dry leaves	64.59	7.56	36.81	612.40
8.	45 cm x 10 cm + Newspaper/ Brown paper	63.88	7.43	36.38	592.07
9.	Control plot	58.79	6.09	33.24	549.37
	S. EM (±)	0.43	0.15	0.38	8.08
	CD (P = 0.05)	1.30	0.46	1.15	24.22

CONCLUSION

Based on the findings of the investigation it may be concluded that 30 cm x 15 cm + Mustard Straw performed exceptionally in obtaining maximum seed yield of Blackgram. Hence, 30 cm x 15 cm + Mustard Straw is beneficial under eastern Uttar Pradesh Conditions**.**

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