Effect of Spacing and Mulching on Growth and Yield of Black gram in Prayagraj, Uttar Pradesh, India

Abstract

The study was carried out at the Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P), India during Zaid 2021 . The soil in the experimental area had a sandy loam texture, was virtually neutral in soil reaction (pH 7.1), was low in organic carbon (0.36 percent), had accessible N (171.2 kg ha -1), available P (15.2 kg ha -1), and available K (15.2 kg ha -1). (232.5 kg ha -1). The experiment consisted of two spacing (30 x 15cm & 45 x 10cm) and 9 treatments and arranged in factorial combination was laid out in Randomized complete Block Design with three replications. The treatments were T_1: 30 x 15 cm + No mulch, T_2: 30 x 15 cm + Mustard Straw, T_3: 30 x 15 cm + Saw dust/ Dry leaves, T_4: 30 x 15 cm + Newspaper/ Brown paper, T_5: 45 x 10 cm + No mulch, T_6: 45 x 10 cm + Mustard Straw, T_7: 45 x 10 cm + Saw dust/ Dry leaves, T_8: 45 x 10 cm + Newspaper/ Brown paper, T_9: Control plot (no mulching done). The findings of this study showed that significantly heigher plant height (43.91 cm), nodules per plant(13.27), Branches per plant(6.53), Plant dry weight (6.39g per plant), Pods per plant(65.09), Seed per pod(7.66),Test weight (37.18 g), werw recorded with 45 x 10 cm + Mustard Straw. However, higher seed yield (669.33 kg ha $^{-1}$), gross returns (Rs. 73626.3 ha $^{-1}$), net return (Rs. 50741.65 ha $^{-1}$) and benefit cost ratio (2.21) were obtained with 30 x 15 cm + Mustard Straw as compared to other treatments.

Key words:, Black gram, pulses, yield , Spacing, Mulching,

INTRODUCTION

Pulses are usually known as meals legumes which are second subsequent to cereals in production and consumption in India. The United nations, declared 2016 as "International year of Pulses" (IYP) to create public cognizance of the nutritional benefits of pulses as part of sustainable food manufacturing aimed toward food protection and vitamins. Pulses are an incorporated part to many diets throughout the globe and that they have great capacity to improve human fitness, conserve our soil, guard the surroundings and make a contribution to global food safety *(The journal of animal and plant science)*

"Black gram (Vigna Mungo) is one of essential pulse crop. The meals legumes, specially the grain or pulses are vital meals stuff in all tropical and subtropical international locations" (**Malik *et al.*,2007**). It is grown throughout India. Black gram is widely grown grain legume and belongs to the circle of relatives "Leguminosae" and genus "Vigna" and assumes large significance from the point of meals and dietary protection in the world. it is also called urd bean, urad dal or urad. It also acts as cowl crop and its deep root system protects the soil from erosion. The crop also improves soil fertility via symbiotic fixation of atmospheric nitrogen in root nodules **.(Singh *et al.*, 2012)**

Black gram is grown properly in moisture retentive light soil, but loamy and clay loam are appropriate for the cultivation of Black gram. Loams to clay loam with neutral pH are nice proper for Black gram cultivation. It's far prone to waterlogged situations of the soil. It defers from other pulses in its peculiarity of accomplishing a quite mucilaginous pasty person, giving additional body to the mass because of lengthy polymer chain of polysaccharide chain of carbohydrates. Tamil Nadu leads first in productiveness with a median yield of 775 kg/ha. It contained 24.7 % protein, 0.6 % fats, 0.9 % fibre and three.7 % ash as well as sufficient amount of calcium, phosphorus and important nutrients. because of inexpensive protein source it's miles certain as "poor man's meat**" (Aslam *et al.*, 2010)**

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"The pulses are grown on 304 lakh ha in India with manufacturing of 14.seventy seven million tones with a productivity of (617 kg ha -1).The total area underneath 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 a place of 2.0 lakh ha with productivity of 425 kg ha -1**." (Komal *et al.*, 2018**) "The average yield obtained at farmers area is low, because no systematic efforts have been made within the beyond to expand a production era, which can also make sure high seed yield of this crop. Vital reasons for low average yield of black gram

at farmers discipline had been the non-stop cultivation of conventional low ability cultivars, use of low seed charge and wrong agronomic practices" **(P Veeramani, 2019**).

"Plant density may have a main impact on the final yield of most of the legumes and the general reaction of yield to growing population is properly documented. To recognize the most yield capacity of black gram for the duration of summer time and wet season, protection of most desirable area made available to man or woman plant is the top importance. Row and plant spacing needs to be optimized to get desired yield. The spacing requirement depends upon the boom behaviour of genotype, environment and control practices. So it is required to hold spacing for acquiring better yield" **(Veeramani, 2019)**

Abiotic and biotic elements may be triumph over by using application of mulches and organic manures. Mulches had been powerful in controlling weeds and additionally protecting in-situ moisture **(Uwah and Iwo, 2011).** "Soil organic rely and moisture become determined to improve beneath mulching. for this reason, mulching serves as one of the high-quality alternatives to manage each the abiotic and biotic factors like rainfall, soil temperature, weeds, etc. which results in exact crop establishment and growth the water use efficiency. Mulching reduces the deterioration of soil, minimizes the weed infestation and assessments the water evaporation. accordingly, it helps more retention of soil moisture and helps in control of temperature fluctuations, improves physical, chemical and organic homes of soil. As it provides vitamins to the soil and ultimately complements the growth and yield of crops" **(Komal *et al.*, 2018)** .hence the modern look at aimed on impact of spacing and mulching on increase and yield of black gram.

MATERIALS AND METHODS

Study area description:

This field experimental was conducted during Zaid 2021 at Crop Research Farm (CRF), Department of Agronomy, Sam Higginbottom University of Agriculture, Technology & Sciences (SHUATS), Prayagraj (U. P). The site is located at 25˚39'42' North latitude, 81˚67'56' East longitude and 98 m altitude above the MSL. The soil is sandy loam in texture and have neutral soil reaction (pH7.1) Less organic carbon(0.36%) ,available N (171.48 kg ha $^{-1}$), available P (15.2 kg ha $^{-1}$) and available K (232.5 kg ha $^{-1}$)

Treatments and design:

The experiment laid out in Randomized completely Block Design consisting of nine treatments such as T_1: 30 x 15 cm + No mulch, T_2: 30 x 15 cm + Mustard Straw, T_3: 30 x 15 cm + Saw dust/ Dry leaves, T_4: 30 x 15 cm + Newspaper/ Brown paper, T_5: 45x 10 cm + No mulch, T_6: 45 x 10 cm + Mustard Straw, T_7: 45 x 10 cm + Saw dust/ Dry leaves, T_8: 45 x 10 cm + Newspaper/ Brown paper, T_9: Control plot replicated three times to determine the effect of Spacing and Mulching on Growth and Yield of Black gram.

Experimental procedure:

T9 variety of black gram was used as a test crop. Urea, DAP and MOP were the source of N, P, K nutrients to fill the requirements. The recommended dose of 20kg of N ha $^{-1,}$ 40 kg P ha $^{-1}$ and 20 kg K ha $^{-1}$ 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 $^{-1}$) were recorded

Data analysis:

All collected data were statistically analyzed using analysis of variance (ANOVA) at 0.05% probability level (Gomez, K. A. and Gomez, A. A. 1984).

RESULTS AND DISCUSSION

Effect of spacing and mulching on the growth of Black gram

Plant height (cm)

The highest plant height (43.91 cm) was observed in 45 x 10 cm + Mustard Straw followed by 45 x 10 cm + saw dust / dry leaves (43.63 cm) application compared to other treatments (Table 1). "The spacing practices had most of its 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 growth of plants 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 (Table 1) "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 per 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 (Table 1). 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)**.

Branches per 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 (Table 1). 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)**.

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

Pods per 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 (Table 2). 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 evaporability 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)**

Seeds per pod

Significantly higher Seeds per 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 (Table 2). 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(Table 2). “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

Significantly highest Seed yield (669.33 kg ha $^{-1}$) was recorded with the treatment application of 30 x 15 cm + Mustard Straw over all the treatments. However, the treatments with (656.53 kg ha $^{-1}$) in 30 x 15 cm + Saw dust/ Dry leaves, (645.50 kg ha $^{-1}$) in 30 x 15 cm + Newspaper/ Brown paper and (652.57 kg ha $^{-1}$) in 45 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 favorable 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[Akankhya Pradhan and Rajesh Singh,2022].

	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 results of the investigation it may be concluded that 30 x 15 cm + Mustard Straw is optimum and suitable to produce maximum seed yield of Blackgram because of plant population and less weed in compared to the other treatment combinations.

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