Int.J.Curr.Microbiol.App.Sci (2020) *9*(6): 2280-2286

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 9 Number 6 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.906.279

Effect of Mulches and Varieties on Yield Attributes and Yield of Green Gram (*Vigna radiata* L.)

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Keywords

Mulching, Variety, Yield Attributes and Yield

Article Info

Accepted:
18 May 2020
Available Online:
10 June 2020

A B S T R A C T

A field experiment was conducted at Agronomy Farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner during *kharif* season 2017. "Effect of Different Mulches on Green Gram (*Vigna radiata* L.) Varieties in North Western Rajasthan" The experiment comprising of four mulching (no mulch, dust mulch, live mulch and mustard straw mulch) and four varieties (HUM 16, IPM-02-03, SML 668 and GM 4) comprising a total of 16 treatment combinations in RBD (Factorial Randomised Blok Design) with three replications. Results showed that different mulches (dust mulch, live mulch and mustard straw mulch) affected yield attributes and yield of green gram over no mulch. Live mulch produced higher number of branches plant^{-1} and number of pod plant^{-1} which was remain statistically at par with mustard straw mulch and dust mulch. Live mulch again remain statistically at par with mustard straw mulch produced higher seed yield (1272 kg ha^{-1}), straw yield (2500 kg ha^{-1}) and biological yield (3772 kg ha^{-1}) of green gram as compared no mulch and dust mulch. Results indicated that different varieties were also affected significant variance on yield attributes and yield of green gram. Variety SML 668 produced higher significantly higher number of branches plant^{-1}, number of pod plant^{-1}, seed yield (1321.5 kg/ ha), biological yield (3817.08 kg/ha) and straw yield (2496.2 kg/ha) as compared to HUM 16, IPM-02-03 and GM 4. Howerever, variety HUM 16 recorded highest test weight and it was remain statistically at par with SML 668 as compared to GM 4 and IPM 02-03.

Introduction

Green gram (*Vigna radiata* L. Wilczek) is an important pulse crop in India and popularly known as moongbean. It belongs to the family leguminoceae sub-family papilionaceae. It is a native of India and Central Asia, (Vavilov, 1926). It contains 24.5% protein, 59.9% carbohydrate and 75 mg calcium, 8.5 mg iron and 49 mg R-carotene per 100 g of split dual (Bhowaland and Bhowmik, 2014).

Green gram extensively cultivated in India it occupies 3.4 m ha area with a production of 1.4 million tonnes with the average yield 475 kg ha^{-1} (Anonymous, 2014-15). Rajasthan is first position with 26 % share of total green gram production in India, which produces

1.05 million tonnes of green gram from 2.12 m ha area with an average yield 495 kg ha^{-1} (Directorate of Agriculture, Rajasthan, Jaipur 2016-17).

Green gram is mostly grown as a rain-fed crop under arid, semi arid, and sub humid conditions (Islam *et al*., 1994). Moisture stress has been reported to reduce plant water potential, total chlorophyll content, nitrate reductase activity (Al-Moftah and Al-Hamaid, 2005).

Mulching is one of the most important agronomic approaches which aimed to protect moisture from soil (Yadov and Dashora, 2003) and acts as barrier to check the fluxes of water and heat from soil surface, helps conserved soil moisture is one efficient water management in green gram cultivation under moisture stress conditions.

Materials and Methods

Experimental site, climate characteristics and soil

A field experiment entitled "Effect of Different Mulches on Green Gram (*Vigna radiata* L.) Varieties in North Western Rajasthan" was carried out during *kharif* season of 2017. The experiment was conducted at the Instructional Farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner during *kharif* 2017. College of Agriculture is situated at 28.01^0N latitude and 73.22^0E longitude at an altitude of 234.7 m above mean sea level. Soil of the experimental site was loamy sand in texture with alkaline reaction (pH 8.5) and organic carbon is very low (0.08 %).

The climate of this zone is typically arid characterized by aridity of the atmosphere and slight salinity in the rhizosphere with extremes of temperatures both in summers and winters. The average annual rainfall of the tract is about 260 mm which is mostly received during the rainy season from July to September. There is wide range of temperatures both in rainy and winter seasons (4.1 to 41.1^{o}C). This region is prone to high wind velocity and soil erosion due to dust storms in summer. The relative humidity of the locality fluctuates in between 20 to 85.9 per cent during 2017. The bright sunshine in *kharif* season of 2017 was recorded to be 5.7 to 9.9.The total rainfall during crop growing season was 124.1 mm. The soil textural class of experimental site was Loamy Sand, low carbon, nitrogen content and slight saline pH 8.2.

Treatments and experimental design

The total number of treatments were applied sixteen with four types of mulching (Control, Dust mulching, Live mulching 5 t ha^{-1} and Mustard straw mulching 5 t ha^{-1}) and four varieties of green gram (HUM 16, IPM02-03, SML 668 and GM 4) respectively. The treatments were applied in randomized block design with three replications. Crop sown at a distance of 30 cm and 10 cm plant to plant distance within row and net plot size 1.8 m X 3.0 m.

Crop establishment and management

Seeds of green gram were treated with carbendazim (2 g kg^{-1} seed) as prophylactic measures against seed borne disease. The crop varieties as per treatment, HUM 16, IPM-02-03, SML 668 and GM 4 were sown by "*kera*" method in rows spaced at 30 cm apart with 5 cm soil depth on 19 July 2017 using seed rate of 20 kg ha^{-1}. Pre-sowing irrigation (*palewa*) of 60 mm was applied before crop sowing to ensure uniform and adequate moisture at before sowing 18 july 2017 time and later all irrigation applied on the base of crop requirement. The calculated amount of

chemical fertilizers (20 kg N and 32 kg P_2O_5 ha^{-1}) were applied through urea and Di-ammonium phosphate. Full dose of nitrogen (20 kg ha^{-1}) and phosphorus (32 kg ha^{-1}) were applied in field at the time of sowing. One spray of imidaclorprid 17.8% SL @ 250 ml ha^{-1} in 1000 litre water was done to protect the crop from sucking pest as per schedule on 11.09.2018.

Yield attributes and yield

Number of pod per plant

The pods of five plants randomly selected from each plot were counted at harvest and average number of pods per plant was worked out.

Number of seeds per pod

Number of seeds per pod was recorded at harvest by counting the seeds of the five randomly collected pods from each plot and the average value was estimated.

Test weight

A seed sample was taken from the produce of each of the net plot harvested and 1000 seeds were counted and weighed to record as test weight in grams.

Seeds yield

After threshing and winnowing of the seeds from each net plot was weighed in kg per plot and convert in kg ha^{-1} for seed yield.

Straw yield

Straw yield in kg per plot was obtained by subtracting the grain yield from biological yield per plot recorded earlier and expressed in kg ha^{-1}.

Biological yield

The harvested material from net area of each plot was thoroughly sun dried. After drying, the produce of individual net plot was weighed with the help of spring balance and recorded as biological yield in kg $plot^{-1}$. Later this was converted into kg ha^{-1}.

Harvest index (%)

The harvest index was calculated by using following formula and expressed as percentage (Singh and Stoskopf, 1971).

$$Harvest\ index\ (\%) = \frac{Economic\ yield\ (kg\ ha^{-1})}{Biological\ yield\ (kg\ ha^{-1})} x\ 100$$

Results and Discussion

Effect of mulches on yield attributes of green gram

The data presented in table 1 reveled that live mulch recorded significantly higher number of branches (8.61) and number of pod $plant^{-1}$ (15.17) as compared to control but it was remain statistically at par with mustard straw mulch and dust mulch. The number of branches enchased by live mulch (24.48 %), mustard straw mulch (23.45 %), and dust mulch (21.69 %) over control and number of pod $plant^{-1}$ was increased dust mulch, live mulch and mustard mulch 12.66, 15.19 and 13.92 per cent, respectively over control.

Distinct positive effect of mulching was noticed on these yield attributes. All these parameters attained higher values with live mulch. The numbers of branches per plant, number of pod $plant^{-1}$ were influenced significantly with different mulching of green gram. Live mulch statistically at par with mustard straw mulch and dust mulch produced significantly higher number of branches per plant and number of pod $plant^{-1}$.

Under water deficit conditions, plants first show reduction in cell division resulting in reduced cell number and stop cell elongation inhibiting leaf expansion. This modification in leaf anatomy is one of the basic causes which lead to a reduction in average leaf size under water limiting situation (Baroowa and Gogoi, 2012).

Effect of verities on yield attributes of green gram

Variety SML 668 recorded significantly higher number of branches plant^{-1} and number of pod plant^{-1} at harvest compared to other varieties. Variety SML 668 produced higher number of branches per plant to the tune of 10.54, 10.54 and 16.61 per cent and number of pod plant^{-1} was increases 10.00, 8.72 and 10.65 per cent over varieties HUM 16, IPM 02-03 and GM 4, respectively. Test weight was also affected by different varieties of green gram. Variety HUM 16 remained statistically at par with SML 668, recorded higher test weight as compared to varieties IPM 02-03 and GM 4.

Yield attributing characters *viz*. number of branches per plant, number of pods per plant were affected due to different varieties of green gram. SML 668 and GM 4 produced the maximum and minimum number of branches per plant and number of pods per plant at harvest, respectively. Test weight is an important yield contributing trait of green gram which was significantly influenced by the prevailing growing conditions and genetic potential of a variety. The highest test weight was recorded in HUM 16 (41.83 g) followed by SML668 (41.60 g) and both were significantly higher than GM 4 (39.75 g) and IPM 02-03 (36.28 g). The variation in number of branches per plant amongst cultivars is mostly due to the differences in their genetic makeup. Similar results are also explained by Anonymous (2007) and Begum *et al.*, (2009).

Table.1 Effect of mulching and varieties on yield attributes of green gram

Treatments	Yield attributes			
	No. of branches per plant	No. of pods per plant	No. of seeds per pod	Test weight (g)
Mulching				
Control	6.92	13.17	8.29	38.46
Dust mulching	8.42	14.83	9.08	40.36
Live mulching	8.61	15.17	9.57	40.23
Mustard straw mulching	8.54	15.00	9.17	40.42
SEm±	0.29	0.38	0.33	0.68
CD (P=0.05)	0.84	1.11	NS	NS
Varieties				
HUM 16	8.01	14.17	8.98	41.83
IPM 02-03	8.01	14.33	9.02	36.28
SML 668	8.86	15.58	9.52	41.60
GM 4	7.60	14.08	8.60	39.75
SEm±	0.29	0.38	0.33	0.68
CD (P=0.05)	0.84	1.11	NS	1.98

NS=Non-significant

Table.2 Effect of mulching and varieties on seed, straw and biological yield and harvest index of green gram

Treatments	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index %
Mulching				
Control	1088.7	2114.4	3203.1	33.96
Dust mulching	1194.4	2316.2	3510.6	34.09
Live mulching	1272.2	2500.3	3772.5	33.73
Mustard straw mulching	1270.9	2466.6	3737.5	34.16
SEm±	19.80	57.20	56.83	0.73
CD (P=0.05)	57.1	165.22	164.12	NS
Varieties				
HUM 16	1181.0	2364.8	3545.9	33.42
IPM 02-03	1187.1	2298.4	3485.5	34.11
SML 668	1321.5	2496.2	3817.8	34.75
GM 4	1136.4	2238.1	3374.6	33.67
SEm±	19.80	57.20	56.83	0.73
CD (P=0.05)	57.19	165.22	164.12	NS
C.V %	5.69	8.43	5.54	7.46

NS=Non-significant

Effect of mulches on yield of green gram

The data indicted in table 2 that seed yield, straw yield and biological yield (kg/ ha) of green gram were affected by different mulches. Live mulch remained statistically at par with mustard straw mulch, produced higher seed yield (1272.2 kg ha^{-1}), straw yield (2500.3 kg ha^{-1}) and biological yield (3772.5 kg ha^{-1}) as compared to dust mulch and control. The magnitude of increase in seed yield with dust mulch, live mulch and mustard straw mulch was 9.71, 16.85 and 16.74 per cent, respectively over control.

Live mulch statistically at par with mustard straw mulch, produced significantly higher seed yield, straw yield and biological yields as compared to dust mulch and control. Most of the study reveal that drought stress greatly reduces the grain yield, which is dependent on the level of defoliation due to the water stress during early reproductive growth (Monneveux *et al.,* 2006). Reduced photosynthesis and decreased translocation of assimilates to the grain during drought result in lower grain weight and produce more empty grains (Liu *et al.,* 2008). Better control of weeds under mulch which could have also favored to increase the yield. Reduced leaf area also decreases carbon assimilation as it is positively related to leaf area and ultimately the yield of the crop as the yield integrates many of the plant morphological processes in a complex way (Graca *et al.,* 2010).

Effect of varieties on yield of green gram

The table 2 reveals that seed yield, straw yield and biological yield were affected by different varieties of green gram. Variety SML 668 recorded significantly higher seed yield (1321.5 kg ha^{-1}) and biological yield (3817.8 kg ha^{-1}) as compared to HUM 16, IPM 02-03

and GM 4.Variety SML 668 increase seed yield 11.89, 11.32 and 16.28 per cent as compared to varieties HUM 16, IPM 02-03 and GM 4 respectively. SML 668 statistically at par with HUM 16 produced significantly higher straw yield as compared to varieties IPM 02-03 and GM 4.

The seed yield, straw yield and yield biological yields were affecting by different varieties of green gram. Variety SML 668 recorded higher seed yield, straw yield and biological yield (kg/ha). Variation in these parameter were influenced by different yield attributing characters which is ultimate influenced by genetic makeup of varieties. . Similar results are also explained by Begum *et al.*, (2009).

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How to cite this article:

Rajpal Bochliya, M.L. Reager and Swetha, C. 2020. Effect of Mulches and Varieties on Yield Attributes and Yield of Green Gram (*Vigna radiata* L.). *Int.J.Curr.Microbiol.App.Sci.* 9(06): 2280-2286. doi: https://doi.org/10.20546/ijcmas.2020.906.279