The Pharma Innovation Journal 2023; 12(11): 2143-2149

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(11): 2143-2149
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www.thepharmajournal.com
Received: 13-08-2023
Accepted: 27-09-2023

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Effect of different mulches on growth, yield and quality of black gram (*Vigna mungo* L.) under rainfed condition

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Abstract
The field experiment was conducted during *kharif* season of 2020-2021 at Experimental Farm Agronomy Section, College of Agriculture, Latur to analyse the effect of different mulches on growth, yield and quality of black gram under rainfed condition. The soil of experimental plot was clay in texture, moderately alkaline in (pH 7.8) nature. The experiment was laid out in Randomized Block Design. The seven treatments were replicated thrice. The treatments were T_1: Control, T_2: Straw mulch @ 5 t/ha, T_3: Spreading of FYM @ 5 t/ha, T_4: Hand weeding cum live mulch, T_5: Spreading of Glyricidia/Leucaena tree leaves/lopping, T_6: Soil mulch by 1 hoeing, T_7: Soil mulch by 2 hoeing. The gross and net plot size of each experimental unit was 5.40 m x 4.50 m and 4.5 m x 3.9 m, respectively. The result showed that different mulches affected growth, yield and quality of black gram over no mulch. Hand weeding cum live mulch being (T_4) statistically at par with straw mulch (T_2) and farm yard manure (T_3) of black gram as compared to no mulch.

Keywords: Black gram, straw, farm yard manure, Glyricidea leaves, soil mulch by hoeing, soil moisture

Introduction
Black gram (*Vigna mungo* L.) is a pulse crop that is a member of the papilionaceous subfamily of the Leguminosae family. Other names for it are mash bean, Urad bean, mungo bean and urid. Black gram is a fantastic source of tasty and easily digestible protein of high quality. In addition to other minerals and vitamins, black gram has a protein level of 26%, which is nearly three times than of cereals. Dal is one of the many ways it is consumed. Idli, dosa and other fermented foods are made from dehusked cotelydon, as are non-fermented foods including boiled Dal, hopper, papad and waries (spicy hollowballs). The plant is used to make animal feed. It is also a superior crop for soil conservation and green manure. It is extremely nourishing and advised for diabetic individuals. Black gram in its whole form is a fantastic source of protein, fibre, a number of vitamins and important minerals including calcium and iron. Black gram has 1.4 percent fat, 3.2 percent minerals, 0.9 percent fibre, 59.6 percent carbohydrates, 154 mg of calcium, 385 mg of phosphorus, 9.1 mg of iron, 347 kcal of calorific value and 10.9 percent moisture. Phosphoric acid is abundant in black gram. It also contributes significantly to maintain soil fertility by enhancing the physical characteristics of the soil, leaving nitrogen for succeeding crops and reducing the need for chemical fertilizers, which causes environmental pollution. Niacin, riboflavin, vitamin B1, B2, and essential amino acids are all present in black gram. Black gram may be grown on a range of soils from light cotton soils to sandy soils. It is a tropical crop with a deep-rooted tap root system that is drought resistant and self- pollinating. 27–30.0 °C is the ideal temperature range for growth. The third significant pulse crop is black gram (urid), which has the potential to significantly increase India's production of pulses. 1st advance estimates show that black gram production in kharif 2021-2022 was 20.5 lakh tonnes over an area of 39.43 lakh hectares (Anon. 2021) [1]. In the years 2020-21, Andhra Pradesh produced 3.65 lakh tonnes of black gram on an area of 3.93 lakh ha (Anon. 2021) [1]. More than 70% of the world's black gram is produced in India, which is also the top producer.

Mulching is a process that uses any suitable material to cover the ground between rows of crops or around tree trunks in order to conserve soil, water and manage weeds through soil solarization. This technique improves soil structure, inhibits weed growth and improves in soil moisture retention. Mulching comes in manyforms, including surface mulching, vertical mulching, mulching with polythene, mulching with pebbles, mulching with dust, mulching with live vegetative barriers, mulching with straw, etc. The benefits of mulching include an increase in soil moisture, a decrease in soil erosion, the regulation of soil temperature, and others. It aids in improvising with relation to soil fertility, soil structure, and soil biological regime. The change of the plant's microenvironment is a benefit of mulching. Mulching is a powerful tool for changing the microclimate in open spaces. Due to its great water efficiency, pulses can be cultivated in places that are prone to drought and assist to increase soil fertility by fixing nitrogen in the soil.

Materials and Methods

A field experiment was conducted during *kharif* season of 2021 at experimental farm department of Agronomy Latur, to study "Effect of different mulches on growth, yield and quality of black gram (*Vigna mungo* L.) Under rainfed condition". The soil of experimental plot was clayey in texture, low in available nitrogen (125.3 kg ha^{-1}), medium in available phosphorous (18.2 kg ha^{-1}) and very high in available potassium (498.58 kg ha^{-1}). The soil was moderately alkaline in reaction having pH 7.8. The experiment was laid out in Randomized Block Design. The seven treatments were replicated thrice. The treatments were T_1: Control, T_2: Straw mulch @ 5 t/ha, T_3: Spreading of FYM @ 5 t/ha, T_4: Hand weeding cum live mulch, T_5: Spreading of glyricidia/leucaena tree leaves/lopping, T_6: Soil mulch by1 hoeing, T_7: Soil mulch by 2 hoeing. The gross and net plot size of each experimental unit was 5.40 m x 4.50 m and 4.5 m x 3.9 m, respectively.

Results and Discussion

Plant height

The data pertaining to the mean plant height as influenced by different treatments was recorded periodically during the crop growth stages and are presented in Table 1. The mean plant height of black gram at 30, 45, 60 DAS and at harvest was 11.18, 18.48, 25.63, 25.63 cm, respectively. The rapidly increase in plant height was observed during 30-60 days and thereafter it remained constant.

The plant of black gram was influenced significantly due to different treatments at all the growth stages of crop except 30 DAS.

It was observed from the data that the plant height increased continuously from emergence up to 60 DAS. Effect of different treatments on height of black gram was found to be significant due to the application of different mulches. At 30, 45, 60 DAS the maximum mean plant height was recorded in hand weeding cum live mulch (T_4) treatment which was found at par with treatment of spreading of FYM @ 5 t/ha (T_3) and treatment of straw mulch @ 5 t/ha (T_2) and also found significantly superior over rest of the treatments. The control treatment (T_1) noticed lowest plant height during all the crop growth stages. Similar results were found by Solanki *et al.*, (2019) [12], Jadhav *et al.*, (2020) [5], Mishra *et al.*, (1996) [6], Awal *et al.*, (2016) [2].

Table 1: Mean plant height (cm) of black gram as influenced by different treatments at various growth stages of crop

Treatment	Days	After	Sowing
	30	45	60
T_1: Control	10.49	15.37	24.33
T_2: Straw Mulch @ 5 t/ha	11.72	19.44	28.64
T_3: Spreading of FYM @ 5 t/ha	11.65	20.62	28.78
T_4: Hand weeding cum live mulch	12.99	21.75	28.96
T_5: Spreading of glyricidia/leucaena tree leaves/lopping	10.66	18.85	25.34
T_6: Soil mulch by 1 hoeing	10.23	16.02	18.33
T_7: Soil mulch by 2 hoeing	10.48	17.27	25.01
S. Em ±	0.55	0.80	1.15
CD @ 5%	NS	2.35	3.38
General mean	11.18	18.48	25.63

Number of functional leaves $plant^{-1}$

The data on mean number of functional leaves $plant^{-1}$ as influenced by different treatments was recorded periodically during the crop growth stages and are presented in Table 2. The number of functional leaves $plant^{-1}$ increased at faster rate from 30 to 45 DAS, and then declined thereafter, due to leaf senescence. The general mean number of functional leaves $plant^{-1}$ of black gram at 30, 45, 60 DAS and at harvest was 15.26, 34.63, 33.69, 30.01 respectively.

The effect of different treatments on number of functional leaves of black gram was found to be significant at all growth stages except 30 DAS. The maximum number of functional leaves $plant^{-1}$ at 45, 60 DAS was recorded with hand weeding cum live mulch (T4) which was at par with spreading of FYM @ 5 t/ha (T3) and application of straw mulch @ 5 t/ha (T2) and also found significantly superior over rest of the treatments. The control treatment (T1) recorded lowest number of functional leaves at various crop growth stages. The results of this investigation are consonance with the findings of Singh *et al*. (2020) [11], Bhattacharya *et al.* (1996) [3].

Table 2: Mean number of functional leaves $plant^{-1}$ of black gram as influenced by different treatments at various growth stages of crop

Treatment	Days	After	Sowing	
	30	45	60	AH
T1: Control	14.77	28.67	31.33	26.05
T2: Straw mulch @ 5 t/ha	15.27	38.53	34.00	32.58
T3: Spreading of FYM @ 5 t/ha	15.28	39.26	35.78	33.38
T4: Hand weeding cum live mulch	16.83	39.54	37.86	35.43
T5: Spreading of glyricidia/leucaena tree leaves/lopping	15.00	34.72	33.51	29.28
T6: Soil mulch by 1 hoeing	14.79	30.03	31.34	26.75
T7: Soil mulch by 2 hoeing	14.87	31.67	32.04	26.63
S. Em ±	0.66	1.57	1.40	1.23
CD @ 5%	NS	4.63	4.14	3.63
General mean	15.26	34.63	33.69	30.01

Leaf area plant^{-1} (dm^2)

Data on mean leaf area plant^{-1} (dm^2) as influenced by different treatments are presented in Table 3.

The mean leaf area plant^{-1} (dm2) at 30, 45, 60 DAS and at harvest was 1.58, 4.63, 3.63, 3.21 dm2, respectively. Data presented in Table 4. Showed that the mean leaf area plant^{-1} was increased rapidly up to 45 days and declined till harvest due to leaf senescence.

Mean leaf area plant^{-1} was influenced significantly due to different treatments at all growth stages, except 30 DAS. At 45 DAS the higher leaf area plant^{-1} was recorded (i.e., 5.16 dm2, respectively) with hand weeding cum live mulch (T_4) which was at par with spreading of FYM @ 5 t/ha (T_3) and Straw mulch @ 5 t/ha (T_2) and also found significantly superior over rest of the treatments. The treatment (T_1) recorded lowest number of functional leaves at 30, 45, 60 DAS and at harvest. Similar results were given by Jadhav *et al.,* (2020) [5], Awal *et al.*, (2016) [2].

Table 3: Mean leaf area plant^{-1} (dm2) of black gram as influenced by different treatments at various growth stages crop

Treatment	Days	After	Sowing	
	30	**45**	**60**	**AH**
T1: Control	1.41	4.11	3.11	2.70
T2: Straw mulch @ 5 t/ha	1.79	4.82	3.82	3.26
T3: Spreading of FYM @ 5 t/ha	1.80	4.91	3.91	3.61
T4: Hand weeding cum live mulch	1.80	5.16	4.16	3.64
T5: Spreading of glyricidia/leucaena tree leaves/lopping	1.42	4.54	3.54	3.24
T6: Soil mulch by 1 hoeing	1.40	4.33	3.33	2.94
T7: Soil mulch by 2 hoeing	1.41	4.52	3.52	3.04
S. Em ±	0.12	0.20	0.20	0.13
CD @ 5%	NS	0.58	0.58	0.39
General mean	1.58	4.63	3.63	3.21

Number of Branches plant^{-1} (cm)

The data on mean number of branches plant^{-1} as influenced by the various treatment was recorded during the crop growth stages and are presented in Table 4.

The mean number of branches plant^{-1} of black gram were 1.98, 3.70, 6.43, 6.43 cm at 30, 45, 60 DAS and at harvest respectively. The effect of different treatments on mean number of branches plant^{-1} was found significant at all crop stages, except 30 DAS. The rate of increase in number of branches was slow up to 30 DAS, fast between 31-45 DAS very fast between 46-60 DAS and thereafter it remained constant.

The highest number of branches plant^{-1} (2.15, 4.14, 7.18, 7.18) was observed in hand weeding cum live mulch (T4) treatment at 30, 45, 60 DAS and at harvest. This treatment does not reach to level of significance at 30 DAS. Whereas, at 45 and 60 DAS, the treatments of hand weeding cum live mulch (T4) which was at par with spreading of FYM @ 5 t/ha (T3) and Straw mulch @ 5 t/ha (T2) and also significantly superior over rest of all the treatments. The lowest number of branches plant^{-1} (1.82, 3.04, 5. 55) was recorded in control treatment (T1) at all growth stages. The results are in accordance with the finding of Solanki *et al.*, (2019) [12], Jadhav. *et al.* (2020) [5], Awal *et al.*, (2016) [2], Deka *et al.*, (2020) [4].

Table 4: Mean number of branches plant^{-1} as influenced by different treatments at various growth stages of crop

Treatment	Days	After	Sowing
	30	**45**	**60**
T1: Control	1.82	3.04	5.55
T2: Straw mulch @ 5 t/ha	2.04	3.94	6.98
T3: Spreading of FYM @ 5 t/ha	2.05	4.03	7.03
T4: Hand weeding cum live mulch	2.15	4.14	7.18
T5: Spreading of glyricidia/leucaena tree leaves/lopping	2.12	3.62	6.36
T6: Soil mulch by 1 hoeing	1.80	3.54	5.59
T7: Soil mulch by 2 hoeing	1.86	3.55	6.33
S. Em ±	0.09	0.17	0.26
CD @ 5%	NS	0.50	0.78
General mean	1.98	3.70	6.43

Mean dry matter accumulation

Data on mean dry matter accumulation plant^{-1} (g) as influenced by various treatments are presented in Table 5. The mean total dry matter production plant^{-1} was 1.63, 3.56, 4.92 and 5.88 g at 30, 45, 60 and at harvest respectively. The dry matter production plant^{-1} was found to be increased continuously at every stages of crop.

The rate of dry matter production was slow at 30 DAS, fast during 30 to 60 DAS and gradually increased up to harvest. At 30 DAS the total dry matter plant^{-1} was found non-significant and found significant at later growth stages of the crop. Hand weeding cum live mulch (T4) recorded highest dry matter accumulation plant^{-1} which was at par with spreading of FYM @ 5 t/ha (T3) and Straw mulch @ 5 t/ha (T2) and also found significantly superior over rest of the treatment. Similar results were given by Jadhav *et al.*, (2020) [5], Awal *et al.*, (2016) [2].

Table 5: Mean total dry matter accumulation (g) plant^{-1} of black gram as influenced by different treatments at various crop growth stages

Treatment	Days	After	Sowing	
	30	**45**	**60**	**AH**
T1: Control	1.35	2.67	3.11	3.80
T2: Straw mulch @ 5 t/ha	1.84	4.07	5.92	6.86
T3: Spreading of FYM @ 5 t/ha	1.90	4.00	6.53	7.25
T4: Hand weeding cum live mulch	2.00	4.55	6.63	7.54
T5: Spreading of glyricidia/leucaena tree leaves/lopping	1.67	3.36	4.89	5.87
T6: Soil mulch by 1 hoeing	1.14	2.95	3.56	4.66
T7: Soil mulch by 2 hoeing	1.54	3.29	3.79	5.15
S. Em ±	0.09	0.24	0.28	0.37
CD @ 5%	NS	0.70	0.83	1.10
General mean	1.63	3.56	4.92	5.88

Mean number of pods plant^{-1}

The data on mean number of pods plant^{-1} as affected by different treatments was recorded at 45, 60 DAS and at harvest are presented in Table 6.

It was detected from data that the number of pods plant^{-1} was increased rapidly during 45-60 DAS and thereafter it remained constant. The mean number of pods plant^{-1} were 9.32, 16.48 and 16.48 at 45, 60 DAS and at harvest respectively. The effect of different treatments was found significant at all growth stages of black gram crop.

Table 6: Mean number of pods plant^{-1} of black gram influenced by different treatments at various growth stages of crop

Treatment	Days	After	Sowing
	45	**60**	**AH**
T1: Control	5.00	10.37	10.37
T2: Straw mulch @ 5 t/ha	12.59	21.52	21.52
T3: Spreading of FYM @ 5 t/ha	13.33	21.53	21.53
T4: Hand weeding cum live mulch	14.00	21.63	21.63
T5: Spreading of glyricidia/leucaena tree leaves/lopping	8.67	15.96	15.96
T6: Soil mulch by 1 hoeing	5.67	11.01	11.01
T7: Soil mulch by 2 hoeing	6.00	13.33	13.33
S. Em ±	0.50	0.75	0.75
CD @ 5%	1.47	2.20	2.20
General mean	9.32	16.48	16.48

At 45 and 60 DAS, maximum number of pods plant^{-1} was 14.00 and 21.63 respectively recorded with the hand weeding cum live mulch treatment (T4). This was comparable with spreading of FYM @ 5 t/ha (T3) and Straw mulch @ 5 t/ha (T2) and also found significantly superior over rest of the treatment.

The results are in accordance with the finding of Pradhan and Singh (2022) [8], Jadhav *et al.*, (2020) [5], Deka *et al.*, (2020) [4].

Leaf Area Index (LAI)

The data of leaf area index are presented in Table 7. Leaf area index is considered as good delegate measures of plant and crop photosynthesis which is an important factor of growth rate and eventually seed yield. There was significant incremental effect of treatments on leaf area index except at 30 DAS.

Mean values of leaf area index at 30, 45, 60 and at harvest were 0.52, 1.54, 1.21 and 1.06 respectively. The leaf area index was slow up to 30 DAS, fast between 31-45 DAS and again slow from 46 DAS up to harvest due to leaf senescence. hand weeding cum live mulch (T4) were recorded maximum leaf area index at all growth stages of crop (0. 6 0, 1. 7 2, 1. 3 8 and 1. 21 respectively) as compared to other treatments. Control treatment (T1) recorded minimum values of leaf area index i.e., 0.47, 1.37, 1.03, 0.89 at 30, 45, 60 and at harvest respectively. Similar results were given by Bhattacharya *et al.*, (1996) [3], Awal *et al.*, (2016) [2].

Table 7: Mean leaf area index (LAI) of black gram as influenced by different treatments at various growth stages of crop

Treatment	Days	After	Sowing	(DAS)
	30	**45**	**60**	**AH**
T1: Control	0.47	1.37	1.03	0.89
T2: Straw mulch @ 5 t/ha	0.59	1.60	1.27	1.08
T3: Spreading of FYM @ 5 t/ha	0.60	1.63	1.30	1.20
T4: Hand weeding cum live mulch	0.60	1.72	1.38	1.21
T5: Spreading of glyricidia/leucaena tree leaves/lopping	0.47	1.51	1.18	1.08
T6: Soil mulch by 1 hoeing	0.46	1.44	1.11	0.98
T7: Soil mulch by 2 hoeing	0.47	1.50	1.17	1.01
S. Em ±	0.04	0.06	0.06	0.04
CD @ 5%	0.12	0.19	0.19	0.12
General mean	0.52	1.54	1.21	1.06

Soil Moisture Studies

Soil Moisture content (%)

The data presented in Table 8 depicted and revealed that different mulch treatments influenced moisture content (%) of soil under black gram crop. The mean values of soil moisture content (%) was influenced significantly due to different treatments at all growth stages. At 30, 45, 60 and at harvest the highest soil moisture content (%) was found with hand weeding cum live mulch (T_4) which was at par with spreading of FYM @ 5 t/ha (T_3) and Straw mulch @ 5 t/ha (T_2) and also found significantly superior over rest of the treatment.

Mean values of soil moisture content at 30, 45, 60 and at harvest were 18.93, 30.20, 39.33, and 40.36 respectively. The soil moisture content increased from 30 DAS up to harvest due to different mulches. Similar results were given by Patil *et al.*, (2010) [7], Deka *et al.*, (2020) [4].

Table 8: Mean soil moisture content (%) of black gram as influenced by different treatments at various growth stages of crop

Treatment	Days	After	Sowing	
	30	45	60	AH
T1: Control	12.96	27.08	35.66	36.69
T2: Straw mulch @ 5 t/ha	23.45	33.91	41.51	42.54
T3: Spreading of FYM @ 5 t/ha	23.07	33.97	42.52	43.52
T4: Hand weeding cum live mulch	26.33	33.99	43.92	44.95
T5: Spreading of glyricidia/leucaena tree leaves/lopping	16.47	28.08	37.76	38.80
T6: Soil mulch by 1 hoeing	13.12	26.67	36.68	37.71
T7: Soil mulch by 2 hoeing	17.08	27.69	37.30	38.32
S. Em ±	1.13	1.68	1.63	1.63
CD @ 5%	3.33	4.96	4.80	4.82
General mean	18.93	30.20	39.33	40.36

Effect of different treatments on weight of pod plant^{-1}, seeds yield plant^{-1} and test weight

Weight of pods plant^{-1} (g): Weight of pods plant^{-1} (g) are presented in Table 9. Weight of pods plant^{-1} (g) determine the yield of black gram crop. The average weight of pods plant^{-1} (g) was significantly influenced due to application different treatments. The mean weight of pods plant^{-1} (g) was 5.68 (g). Maximum weight of pods plant^{-1} was recorded with hand weeding cum live mulch (T4) (8.41 g) which was found at par with spreading of FYM @ 5 t/ha (T3) and Straw mulch @ 5 t/ha (T2) and also found significantly superior over rest of the treatment. Control alone (T1) observed minimum weight of pods plant^{-1} (3.00 g). The present findings are in collaborative with those of Jadhav *et al.* (2020) [5].

Seed yield plant^{-1}

Data on seed yield plant^{-1} as influenced by various treatments are presented in Table 9. The mean seed yield plant^{-1} was 4.96 (g). The higher seed yield plant^{-1} was observed with hand weeding cum live mulch treatment (T4) which was at par with spreading of FYM @ 5 t/ha (T3) and, Straw mulch @ 5 t/ha (T2) and also found significantly superior over rest of the treatment. Control treatment alone (T1) observed lowest seed yield plant^{-1} (2.55 g).

Test weight (g)

Data on test weight (g) as influenced by various treatments is presented in Table 9. Mean test weight of black gram was 42.91 g. Among the different treatments, the test weight of black gram was not found significantly. The higher test weight (44.23 g) was obtained with the hand weeding cum live mulch. Application of control (T1) observed lower seed yield plant^{-1} (40.67 g). Similar results were given by Singh and Das, (1998) [10].

Table 9: Weight of pods plant^{-1}, seed yield plant^{-1} and test weight of black gram as influenced by various treatments

Treatment	Weight of pods plant^{-1} (g)	Seed yield plant^{-1} (g)	Test weight (g)
T_1: Control	3.00	2.55	40.67
T_2: Straw mulch @ 5 t/ha	8.00	7.09	44.10
T_3: Spreading of FYM @ 5 t/ha	8.17	7.17	44.17
T_4: Hand weeding cum live mulch	8.41	7.42	44.23
T_5: Spreading of glyricidia/leucaena tree leaves/lopping	5.00	4.26	43.00
T_6: Soil mulch by 1 hoeing	3.09	2.82	41.67
T_7: Soil mulch by 2 hoeing	4.14	3.42	42.57
S.Em ±	0.25	0.34	2.35
CD @ 5%	0.73	1.00	NS
General mean	5.68	4.96	42.91

Seed yield (kg ha^{-1})

Data on mean seed yield (kg ha^{-1}) as influenced by different treatments are presented in Table 10. The mean seed yield (kg ha^{-1}) of black gram was 1433 kg ha^{-1}.

The seed yield of black gram was differed significantly due to different treatments. The significantly higher seed yield (2129 kg ha^{-1}) was produced with hand weeding cum live mulch (T_4) which was at par with spreading of FYM @ 5 t/ha (T_3) and Straw mulch @ 5 t/ha (T_2) and also found significantly superior over rest of the treatment. Application of control treatment (T1) observed lower seed yield (730 kg ha^{-1}). Similar results were found by Pradhan and Singh (2022) [8], Jadhav *et al.*, (2020) [5], Solanki *et al.*, (2019) [12], Awal *et al.*, (2016) [2].

Straw yield (kg ha^{-1})

Data on straw yield kg ha^{-1} as influenced by different treatments are presented in Table 10. The mean straw yield was recorded as 2876 kg ha^{-1}.

The straw yield kg ha^{-1} was significantly influenced by various treatments. The maximum straw yield (4360 kg ha^{-1}) was recorded with hand weeding cum live mulch (T_4) which was found significantly superior over all the treatment, except spreading of FYM @ 5 t/ha (T_3) and Straw mulch @ 5 t/ha (T_2). The lower straw yield was produced by the application of T_1 (1456 kg ha^{-1}) of black gram. Similar results were given by Savani *et al*., (2017) [9], Solanki *et al*., (2019) [12], Deka *et al*., (2020) [4].

Table 10: Data on mean seed yield (kg ha^{-1}), straw yield (kg ha^{-1}) are presented

Treatments	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})
T_1: Control	730	1456
T_2: Straw mulch @ 5 t/ha	2039	4294
T_3: Spreading of FYM @ 5 t/ha	2058	4232
T_4: Hand weeding cum live mulch	2129	4360
T_5: Spreading of glyricidia/leucaena tree leaves/lopping	1232	2197
T_6: Soil mulch by 1 hoeing	803	1584
T_7: Soil mulch by 2 hoeing	1044	2011
S.Em ±	91.8	156.7
CD @ 5%	270.8	462.3
General mean	1433	2876

Mean protein content (%) and mean protein yield (kg/ha^{-1})

Protein content (%)

Data on protein content as affected by various treatments is presented in Table 11. The mean protein content was not influenced significantly due to different treatments. Mean protein content was 21.55%. Highest protein content recorded with hand weeding cum live mulch (T_4) which was closely followed by spreading of FYM @ 5 t/ha (T_3) and Straw mulch @ 5 t/ha (T_2).

Protein yield (kg ha^{-1})

The data on mean protein yield of black gram as influenced by different treatment is presented in Table 11. The mean protein yield of black gram was 327 kg ha^{-1}, the mean protein yield of black gram was influenced significantly due to different treatments. Hand weeding cum live mulch (T_4) produced significantly higher protein yield (517 kg ha^{-1}) over rest of the treatments, except spreading of FYM @ 5 t/ha (T_3) and Straw mulch @ 5 t/ha (T_2).

Table 11: Protein content (%), Protein yield (kg ha^{-1}) of black gram as influenced by different treatments

Treatment	Protein Content (%)	Protein Yield (kg ha^{-1})
T1: Control	22.49	151
T2: Straw mulch @ 5 t/ha	22.62	467
T3: Spreading of FYM @ 5 t/ha	22.20	452
T4: Hand weeding cum live mulch	23.99	517
T5: Spreading of glyricidia/leucaena tree leaves/lopping	22.22	296
T6: Soil mulch by 1 hoeing	22.23	180
T7: Soil mulch by 2 hoeing	22.48	230
S. Em ±	2.77	15.0
CD @ 5%	NS	44.4
General mean	21.55	327

Conclusions

On the basis of present investigation it can be concluded that the result showed that different mulches affected growth, yield and quality of black gram over no mulch. Hand weeding cum live mulch (T_4) recorded higher growth attributes, yield attributes which achieved profitable gross monetary return, net monetary return and B: C ratio.

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