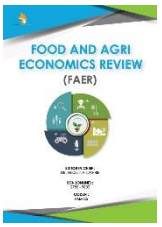
ZIBELINE INTERNATIONAL™ PUBLISHING

ISSN: 2785-9002 (Online)
CODEN: FAERCS

Food and Agri Economics Review (FAER)

DOI: http://doi.org/10.26480/faer.02.2023.55.60



RSEARCH ARTICLE

DIFFERENTIAL RESPONSE OF SPACING AND MULCHING MATERIALS ON GROWTH AND YIELD OF OKRA (ABELMOSCHUS ESCULENTUS L.) IN MORANG, NEPAL.

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ARTICLE DETAILS

Article History:

Received 12 May 2022
Revised 15 June 2022
Accepted 18 July 2023
Available online 27 July 2023

ABSTRACT

One of the main vegetable crops grown by farmers in Nepal in the summer is okra (Abelmoschus esculentus L.). Its total yield growth and quality are pretentious by diverse cultivation methods. This study was directed at Jahada -4 Morang, Nepal from 23 February to 30 May 2022. Three replications of the field experiment were conducted using the random complete block design (RCBD). Three inter-row spacings (30, 40, and 60) and three different types of mulching ingredients make up the treatment (silver plastic, paddy straw and bare soil or no mulch). The objective of this study was to determine how differently inter-row spacing and mulching materials affected okra development and yield. Okra produced the most (582.10 g/plant) when mulched with silver plastic, followed by paddy straw (502.74 g/plant), bare soil, and no mulch (445.26 g/plant), in that order. The germination percentage, DAS to first flowering, plant height, branch count, pod length, pod weight, yield per plant, and yield per plot are all improved by using silver plastic mulch. The spacing provide no significant effect however yield of okra was highest (20,9625 g/plot) under 30x30 spacing followed by (15,786 g/plot) under 45x30 and (11,824.37 g/plot) under 60x30cm respectively. Silver plastic mulch combined with 30x30 the greatest okra production was achieved by spacing. This study recommends that farmers of the Morang increase yield, and cultivate okra under a layer of silver plastic mulch at a spacing of 30 * 30 cm.

KEYWORDS

Mulching, Okra, Spacing, Yield

1. INTRODUCTION

One of the well-known vegetables is okra (Abelmoschus esculentus (L. Moench)) vegetables which originated from tropical America and belong to the family Malvaceae and was cultivated for the first time in the 12th century in Egypt (Jha et al., 2018). It is a warm-season crop with vigorous, half-woody, herbaceous, semi-fibrous and dicotyledonous character (Madisa et al., 2015). Tender pods are the edible parts of okra used in fresh or dry powder in soup and stew (Dalorima et al., 2014). With 9.6% carbs, 2.25% protein, 1.1% fibre, and 0.2% fat in addition to various vitamins and minerals like iron, potassium, magnesium, salt, calcium, zinc, nickel, and manganese, okra has a high nutritional value and medicinal properties (Singh et al., 2014). Okra contains two types of fibre, soluble and insoluble. Soluble fibre lowers cholesterol levels and lowers the risk of heart disease, while insoluble fibre helps to maintain a healthy digestive system, particularly the intestine. Okra's fibre also reduces the rate at which sugar is absorbed, making it a useful anti-diabetic vegetable (Khan and Rab, 2019). The okra plant also has ornamental value due to its hibiscus-like flower and erect structure. Flowers of okra can be used in the living room due to their beautiful nature and also the dry pods can be used as crafts (Maurya et al., 2013). One of the most extensively planted vegetables in Nepal is okra, which is produced in large quantities in the provinces of Jhapa, Morang, Saptari, Dhanusha, Mahottari, Rautahat, Bara, Chitwan, and Kailali. Okra was produced throughout the entire nation in 103,353 metric tons on an area of 9337 ha with a productivity of 11.07 tons per hectare (MoAD, 2022).

Growth, yield and superiority of okra are hindered due to the adoption of inappropriate cultivation practices due to a lack of knowledge and awareness (Bake et al., 2007). Mulching is a practice adopted in nearly all home gardens due to its multiple functions as reduction of weed growth, maintaining uniform moisture conditions in the soil, decreasing water loss through evaporation, decreasing soil erosion caused due to rainfall impact, varying the soil's temperature and adding nutrients and humus to the soil as organic mulches decompose, improving the soil's tilts and moisture-holding ability and ultimately increase the yield (Relf and McDaniel, 2020). Different types of organic as well as inorganic mulches with different colours are used by farmers as well as researchers for growing vegetables. Utilizing silver plastic mulch on some crops reduces the spread of diseases brought on by insects. (Jha et al., 2018).

In the case of proper management okra plants produce green fruits continuously for several months. One of the important elements that determine efficiency is the plant population obtained from inter and intra-row spacing, profitable crop yield and proper land use (Agba et al., 2011). Okra plant being a warm season crop requires proper sunlight, moisture and nutrients meanwhile Farmers attempt to lower the cost of production by increasing the plant population per unit area to produce a larger yield because they have limited land holdings and fertilizer prices are expensive

Quick Response Code	Access this article online	
	Website: www.faer.com.my	**DOI:** 10.26480/faer.02.2023.55.60

Cite The Article: Barun Panthi, Chandan K. Shreevastav, Dipak Kattel, Januka Dahal (2023). Differential Response of Spacing and Mulching Materials on Growth and Yield of Okra (Abelmoschus Esculentus L.) in Morang, Nepal. *Food and Agri Economics Review, 3(2): 55-60.*

(Khan & Rab, 2019). Up to a certain point, we can improve yield per unit area by expanding plant population, but after that point, the yield declines since there are fewer resources available for plant growth (Paththinige et al., 2008). According to Agba et al., (2011), Okra should be grown with a population of 55,555 plants.

2. Materials and Methods

2.1 Experimental Detail

From 23 February to 30 May 2022, an experiment was carried out at Jahada -4 Morang, Nepal. It is located in Province No. 1's Terai area at an elevation of 119 meters above mean sea level. It has a 1,855 km2 area and is located at 26° 37'23.23" latitude and 87° 29'5.45" east longitude. The study area is in Nepal's subtropical region. It has three different seasons: scorching summer March–May), cold winter (November–February), and wet monsoon (June–October). The study was carried out from February to May. The months of July to September see the most precipitation.

2.2 Experimental Design

The test was conducted on two factors: Randomized Complete Block Design (RCBD). Each treatment was replicated thrice. There were 27 plots each having area of 2*2m2. Five plants were taken as sample plants from each plot through a simple random sampling method. The space between each plot was kept at 50cm and the space between each block was 1m.

Nine treatments total, which was grouped in three-by-three factorial combinations, made up the experiment. Silver Plastic Mulch (SPM), Rice Straw Mulch (RSM), and No Mulch as Control comprised the first component. The second element involved three different spacings for the okra plants: S1 = 30 cm * 30 cm, S2 = 45 cm * 30 cm, and S3 = 60 cm * 30 cm.

2.3 Plant Material

Okra of the Venus variety was procured from a local agro vet near the experimental site. On the recommendation of a subject matter specialist, this variety was chosen because of its distinctive qualities, which are as follows:

- Fruit is suitable for delayed harvesting since it remains soft for a long period after being picked.
- Tolerance for the mosaic vein with a yellow vein

Seeds were soaked the night before sowing. Field preparation included one deep ploughing, three light ploughings, and planking.

2.4 Field Observation and Recording

2.4.1 Sampling Technique

From each plot randomly 5 sampled plants were selected and growth and harvesting data was recorded.

2.5 Growth Parameters

2.5.1 Germination Percentage

By counting the total number of seeds that germinated, dividing by the total number of seeds sowed, and multiplying by 100%, the germination percentage was determined.

2.5.2 Plant Height (cm)

Following the selection and tagging of 5 sample plants from each plot, measurements of the plant height were made starting 15 days after sowing and continuing at 45, 60, 75, and 90 DAS. Its dimensions are taken from bottom to top.

2.5.3 Leaf Number

Leaf numbers were counted from selected sample plants.

2.5.4 Branch Number

The number of branches counted from the sampled plant.

2.5.5 Days to First Flowering

It was observed by counting the days taken from the sowing of the seed to the first flowering.

2.5.6 Pod Length

The length of each pod from top to bottom was measured and the average was calculated.

2.5.7 Pod Diameter

The thickness of each pod was measured and the average was calculated.

2.5.8 Pod Weight

The weight of each Pod was measured and averages were calculated.

2.5.9 Yield Per Plot and Yield Per Plant

By weighing the harvest from a sample plant and calculating the average, the yield was determined.

2.6 Statistical Analysis

The significance of treatments was determined using statistical analysis of the data gathered from the experimental plots on numerous parameters following the rules of experimental design. The gathered information was tallied in Microsoft Excel 2019. To determine the significant differences between the mean values at a 5% level of significance, Tukey's Pairwise test was used. The significance will be assessed using the ANOVA table in the following way. The grand mean and coefficient of variance were determined using R-studio 4.2.1.

3. Results

The purpose of the experiment was to study the effects of mulching and spacing on okra production. This section has discussed and interpreted each parameter's results. Germination percentage was significantly different ($p<0.05$) according to the mulching treatment while it was not significantly different according to the spacing treatment. The highest percentage of germination (78.81%) was observed on silver plastic mulching. Black plastic mulching was significantly different with paddy straw (66.09%) while it was not significantly different with no mulch (75.09%) treatment concerning germination percentage. The interaction of spacing and mulching for germination percentage did not differ significantly.

Table 1: Effect of Mulching and Spacing of Okra on DAS To 50%Germination, Germination Percentage and DAS for First Flowering

Treatment	DAS to 50% Germination	Germination%	DAS for first flowering
Mulching			
Silver plastic	7.66±0.17	78.81±3.09^{a}	49±0.82^{b}
Paddy straw	8.89±0.26	66.09±3.45^{b}	51.78±0.95^{a}
No much	8.77±0.60	75.09±2.57^{ab}	51.89±0.86^{a}
MSD	1.37	11.65*	2.91*
Spacing (cm)			
30x30	8.56±0.34	70.11±3.01	49.78±1.0
45x30	8.67±0.47	76.17±4.25	51.22±1.10
60x30	8.11±0.45	73.71±3.05	51.67±0.75
MSD	1.37^{ns}	11.65^{ns}	2.91^{ns}
Mean	8.44	73.33	50.89
C.V (%)	13.9	13.06	4.71
Spacing × Mulching			
Mean	8.44	73.33	50.89
CV%	13.9	13.66	4.71
MSD	3.28^{ns}	27.82^{ns}	6.96^{ns}

Note: According to Tukey's Pairwise test at the 0.05 level of significance, the common letter (ns) in the column denotes non-significant difference; ** significant at the 1% level of significance; and *** significant at the 0.1% level of significance. Mean Significance Difference (MSD) and Coefficient of Variation (CV)

DAS for first flowering was significantly different ($p<0.05$) according to the mulching treatment while it was not significantly different according to the spacing treatment. Faster flowering was observed on silver plastic mulching (49 DAS) but was significantly different with paddy straw (51.78) and no mulch (51.98DAS) treatment concerning DAS for first floweringThe effects of spacing and mulching on okra did not differ meaningfully.

Plant height at all heights after sowing was significant ($p<0.05$) according to mulching treatment while it was not significant according to spacing treatment at all DAS as shown in the table. Maximum plant height was observed on silver plastic mulch (117.65 cm) mulching treatment at all DAS and was significantly different with other treatments except on 30DAS. Paddy straw treatment (103.91cm) and no mulch treatment (100.65cm) didn't have significant differences in plant height. For plant height, there was no discernible alteration in how spacing and mulching interacted.

Leaf number at all DAS was significant ($p<0.05$) according to mulching treatment while it was not significant according to spacing treatment at all DAS as shown in the table. The maximum number of leaves was observed on silver plastic mulching treatment at all DAS except at 90DAS and was significantly different with other treatments except at 70 DAS. In 90 DAS maximum leaves were obtained from Paddy straw (42.71) followed by no mulch (40.93) and silver plastic (37.22). The relationship between spacing and mulching for plant height did not change significantly.

Table 3: Effect of Mulching and Spacing of Okra on Plant Height

Treatment	Plant height in cm				
	30DAS	45DAS	60DAS	75DAS	90DAS
Mulching					
Silver plastic	7.32±0.27^{a}	16.20±0.79^{a}	48.08±2.72^{a}	85.93±4.93^{a}	117.65±4.82^{a}
Paddy straw	7.05±0.24^{ab}	12.30±0.68^{b}	32.10±1.90^{b}	66.76±3.17^{b}	103.91±4.20^{b}
No mulch	6.13±0.29^{b}	11.4±0.70^{b}	29.85±1.30^{b}	62.44±3.56^{b}	100.65±4.07^{b}
MSD	1.0*	2.46***	7.29***	7.33***	9.96**
Spacing (cm)					
30X30	6.83±0.36	13.23±0.83	38.59±2.96	74.18±4.72	108.4±4.40
45X30	6.85±0.36	14.14±1.3	37.82±4.2	70.22±6.88	108.94±7.18
60X30	6.82±0.22	12.55±0.8	33.61±3.01	70.73±4.68	104.87±4.62
MSD	1.0^{ns}	2.46^{ns}	7.29^{ns}	7.33^{ns}	9.96^{ns}
Mean	6.84	13.30	36.68	71.71	107.4
C.V (%)	12.10	15.20	16.34	8.4	7.63
Spacing × Mulching					
Mean	6.84	13.30	36.68	71.71	107.4
C.V (%)	12.10	15.20	16.34	8.4	7.63
MSD	2.40^{ns}	5.58^{ns}	17.46^{ns}	17.50^{ns}	23.81^{ns}

Note: The common letter (ns) within the column indicates a non-significant difference based on Tukey's Pairwise test at 0.05 level of significance, ** significant at 1% level of significance, *** significant at 0.1% level of significance. CV – Coefficient of Variation, MSD – Mean Significance Difference

Table 4: Effect of Mulching and Spacing of Okra on The Number of Leaves

Number of leaves				
30DAS	45DAS	60DAS	75DAS	90DAS
5.71±0.23^{a}	12.64±0.51^{a}	24.67±0.73^{a}	37.18±1.21^{a}	37.22±0.97^{b}
4.76±0.18^{b}	10.16±0.64^{b}	19.56±0.95^{b}	35.73±1.42^{ab}	42.71±1.04^{a}
5.07±0.19^{b}	10.02±0.41^{b}	19.02±0.75^{b}	34.51±1.31^{b}	40.93±1.30^{a}
0.61**	4.80**	3.03***	2.42*	2.89***
5.09±0.21^{ab}	10.71±0.67	20.38±1.20	34.84±1.62	40.2±1.48
5.53±0.24^{a}	11.58±0.69	21.49±1.01	36.62±1.27	39.8±1.36
4.91±0.23^{b}	10.53±0.61	21.37±1.36	35.96±1.13	40.86±1.13
0.61^{ns}	2^{ns}	3.03^{ns}	5.78^{ns}	6.88^{ns}
5.17	10.94	21.08	35.81	40.29
9.74	15.10	11.83	5.56	5.88
Spacing × Mulching				
5.17	10.94	21.08	35.81	40.29
9.74	15.10	3.03	5.56	2.89
1.47^{ns}	4.80^{ns}	7.25^{ns}	5.78^{ns}	6.88^{ns}

Note: The common letter (ns) in the column denotes non-significant differences according to Tukey's Pairwise test at the 0.05 level of significance, ** significant differences at the 1% level of significance, and *** significant differences at the 0.1% level of significance. Mean Significance Difference, Coefficient of Variation, and CV

The branch number at 45 DAS only after sowing was significant according to mulching treatment while it was not significant at other DAS and spacing treatment at all DAS. The maximum number of branches (2.40) was observed on silver plastic mulching treatment at 45 DAS. Black plastic mulching was significantly different from other treatments only at 45 DAS. Paddy straw mulching (2.11) and no mulch (2.13) treatment don't have any significant difference in branch numbers. The interplay of branch number and spacing and mulching did not differ significantly.

Pod length was significantly different ($p<0.05$) according to the mulching treatment while it was not significantly different with spacing treatment. Maximum pod length was observed in silver plastic mulch (13.2cm) treatment and was not significantly different with paddy straw (13.28cm) but was significantly different with no mulch treatment (12.75cm). When spacing and mulching were combined, there was no discernible difference in pod length.

Pod weight was significantly different ($p<0.05$) according to mulching treatment while it was not significantly different with spacing treatment. Maximum pod weight was observed on silver plastic mulching treatment (17.84g) and was not significantly different with paddy straw (17.69g) but is significantly different with no mulch treatment (16.56g). The relationship between spacing and mulching for pod length did not change significantly.

Table 5: Effect of Mulching and Spacing of Okra on The Number of Branches

Treatment	Number of Branches				
	30DAS	45DAS	60DAS	75DAS	90DAS
Mulching					
Silver plastic	2.09±0.09	2.40±0.13^{a}	2.58±0.15	3.33±0.24	3.69±0.13
Paddy straw	1.71±0.20	2.11±0.12^{b}	2.64±0.12	3.13±0.12	3.53±0.25
No mulch	1.80±0.11	2.13±0.08^{ab}	2.58±0.09	3.27±0.11	3.51±0.22
MSD	0.44^{ns}	0.28*	0.39^{ns}	1.09^{ns}	0.53^{ns}
Spacing (cm)					
30X30	1.78±0.11	2.13±0.12	2.47±0.11	3.13±0.12	3.44±0.14
45X30	2.07±0.13	2.29±0.10	2.73±0.13	3.31±0.16	3.64±0.22
60X30	1.76±0.18	2.22±0.14	2.60±0.12	3.27±0.20	3.64±0.22
MSD	0.44^{ns}	0.28^{ns}	0.39^{ns}	0.46^{ns}	0.53^{ns}
Mean	1.87	2.21	2.6	3.23	3.58
C.V (%)	19.52	10.30	12.22	11.62	12.29
Spacing × Mulching					
Mean	1.87	2.21	2.6	3.23	3.58
C.V (%)	19.52	10.30	12.22	11.62	12.29
MSD	1.06^{ns}	0.66^{ns}	0.92^{ns}	1.09^{ns}	1.28^{ns}

Note: The common letter (ns) inside the column denotes a non-significant difference based on Tukey's Pairwise test at 0.05 level of significance, ** significant at 1% level of significance, and *** significant at 0.1% level of significance. Coefficient of Variation (CV) and Mean Significance Difference (MSD)

Table 6: Effect of Mulching and Spacing of Okra on Pod Length, Pod Diameter, Pod Weight

Treatment	Pod Length in cm	Pod Diameter in cm	Pod weight gm
Mulching			
silver plastic	13.32±0.13^{a}	1.62±0.02	17.84±0.48^{a}
Paddy straw	13.28±0.13^{a}	1.68±0.12	17.69±0.17^{a}
No much	12.75±0.18^{b}	1.53±0.01	16.56±0.33^{b}
MSD	0.61*	0.24^{ns}	1.30*
Spacing (cm)			
30x30	13.16±0.14	1.57±0.01	17.30±0.40
45x30	13.06±0.18	1.59±0.03	17.40±0.43
60x30	13.12±0.20	1.68±0.12	17.40±0.38
MSD	0.61^{ns}	0.24^{ns}	1.30^{ns}
Mean	13.12	1.61	17.37
C.V (%)	3.8	12.57	6.14
Spacing × Mulching			
Mean	13.12	1.61	17.37
C.V (%)	3.8	12.57	6.1
MSD	1.45^{ns}	0.59^{ns}	3.10^{ns}

Note: Tukey's Pairwise test at 0.05 level of significance, ** significant at 1% level of significance, and *** significant at 0.1% level of significance are all indicated by the common letter (ns) within the column. Mean Significance Difference (MSD) and Coefficient of Variation (CV)

Table 7: Effect of Mulching and Spacing of Okra on Number of Pods Per Plant, Per Plot, Weight of Pods Per Plant, Weights of Pods Per Plot

Factor	Number of Pods per plant	Number of Pods per plot	Yield per plant	Yield per plot
Mulching				
silver plastic	29.82±1.81^{a}	148.11±9.08^{a}	582.10±36.89^{a}	2910.51±184.44^{a}
Paddy straw	25.76±1.70^{b}	128.78±8.52^{ab}	502.74±28.60^{ab}	2513.72±142.98^{ab}
No mulch	24.38±1.04^{b}	121.89±5.18^{b}	445.26±20.64^{b}	2226.30±103.21^{a}
LSD	3.94**	19.49**	84.79**	423.97**
Spacing				
30x30	24.89±0.78	123.44±3.89	471.76±17.64	2358.82±88.2
45x30	27.4±2.0	137±10.4	526.20±45.46	2630.98±212.28
60x30	27.67±1.95	138.33±9.75	532.15±37.34	2660.674±186.68
LSD	3.94^{ns}	19.49^{ns}	84.79^{ns}	423.97^{ns}
Mean	26.65	132.92	510.04	2550.18
C.V%	3.94	12.06	13.68	13.67
Spacing × Mulching				
Mean	26.65	132.92	510.4	2550.18
C.V (%)	12.15	12.05	13.68	13.67
LSD	9.41^{ns}	46.54^{ns}	202.48^{ns}	1012.4^{ns}

Note: The column's common letter (ns) denotes differences that are not statistically significant according to Tukey's Pairwise test at the 0.05 level of significance, ** significant at the 1% level of significance, and *** significant at the 0.1% level of significance. Mean Significance Difference, Coefficient of Variation, and CV

The number of pods per plant was significantly different (P<0.05) according to the mulching treatment while it was not significantly different with the spacing treatment. The maximum number of pods harvested from a silver plastic mulch (29.82) was significantly different with paddy straw (25.75) and no mulch treatment (24.38). The relationship between spacing and mulching for pod length showed no discernible difference.

Yield per plant was meaningfully different (p<0.05) according to mulching treatment while it was not significantly different with spacing treatment. Maximum yield per plant was obtained from black plastic mulching (582.10g) and was significantly different with no mulch treatment (445.26) while it was not significantly different with paddy straw treatment (502.74g). There was no significant difference in the interaction of spacing and mulching for pod length.

4. Discussion

Higher germination was obtained in mulched conditions and the germination percentage was greatly reduced in no-mulch conditions; it may be due to the limiting water content and extremes temperature which are the major stress and constrain seed germination in no-mulching (Godawatte and De Silva, 2015). In the case of onion significant variation was observed in onion seed germination due to different mulches applied, the highest germination (83.90%) was observed from black polythene and the lowest germination (69.54%) was found from no mulch treatment (Anisuzzaman et al., 2009). Okra flowering was significantly impacted by mulch. Plastic mulch, grass mulch, and hoe-wooded plants flowered before wood-shaving mulching plants, and slower flowering was observed in unweeded plants, which may be due to higher moisture stress caused by transpiration on weedy plots as well as due to the above-ground competition for weed (Olabode, et al., 2007). Onion plants are grown under black and white plastic mulch flowers 5 and 3 days earlier than no mulch (Anisuzzaman, et al., 2009At 45 DAS (116.20 cm) and 60 DAS (134.9 cm), the plastic mulch produced the tallest okra plants (Jha, et al., 2018). Under polythene, moisture conservation was high due to the prevention of evaporation of moisture from the soil surface (Dalorima et al., 2014). In the chilli plant, mulches had a substantial impact on plant height; the clear plastic mulch produced the tallest plants (78.45cm) followed by black plastic (77.58cm), blue plastic (77.03cm) and the smallest (61.5cm) was observed in control plot with no mulch (Ashrafuzzaman et al., 2011). Tomato cultivated on corn and rape straw contributes to an increased height of the plant compared to rye straw (Kosterna, 2014). Also in summer squash maximum plant height was observed black plastic mulch (138.22cm) (Kumar and Sharma, 2018). The highest number of leaves was obtained from mulching i.e. Black plastic mulch (28.33) while the minimum value was found from no mulch treatment (Akter et al., 2020). In the case of chilli also, mulching provides a significant effect on leaf number where mulching provides a higher number of leaves than no mulch (Ashrafuzzaman et al., 2011). The number of branches per plant was affected significantly by mulch type i.e. okra plants grown under plastic mulch have a higher number of branches than okra plants grown under no mulch due to less competition with weeds (Olabode et al., 2007). The number of branches per plant was affected significantly by mulch type i.e. okra plants grown under plastic mulch have a higher number of branches than okra plants grown under no mulch due to less competition with weeds (Olabode et al., 2007; Bhobhriya et al., 2019). In an experiment to determine the impact of several mulch types on the yield-contributing traits and yield of okra (Abelmoschus esculentus), paddy straw, black mulch, white mulch, and control were used as the treatments. Paddy straw mulch (9.22gm) had the highest pod weight, followed by white mulch (8.49gm), black plastic mulch (8.60gm), and control treatment (8.89gm).

The average fruit weight of okra was unaffected by the use of plastic mulch (Mahadeen, 2014). Black plastic mulch provides the highest average fruit weight (92.98g) in summer squash (Kumar and Sharma, 2018) The number of pod per plant varied significantly with mulch type, plastic mulch have a significantly higher number of pods per plant i.e. 12.11 (Olabode, 2007). In the combination treatment of organic and mulching, the average maximum number of pods was recorded (52.67), but the control treatment only produced a little amount of fruit (35.33) (Onamica et al.). The number of fruits per plant was highest in black plastic mulch (472 plant-1), then blue (443 plant-1), clear mulch (434 plant-1), and control exhibited the least (335 plant-1) fruits per plant. Mulches also had a favourable effect on fruit set in Chile (Ashrafuzzaman, et al., 2011). In cucumbers, the black plastic mulch produced the most fruits per plant (8.78), while the absence of mulch produced the fewest (4.17) (Akter et al., 2020). The result is similar to the result of the field experiment conducted by (Jha et al., 2018Okra yield were not significantly impacted by spacing treatment, but mulching did. Silver plastic mulch produced a higher yield (8104 kg/ha) than the control (5161 kg/ha), panicum repens (3901 kg/ha), and lantana camara (3701 kg/ha), and closer spacing (30x30), when combined with silver plastic mulch, produced a higher yield than wider spacing. When compared to not using mulch, red okra produced more pods (Godawatte and De Silva, 2015). The yield of okra was higher in plastic mulch followed by hoe-weed, control, wood-shaving and no mulch (Olabode et al., 2007; Bhobhriya et al., 2019). Paddy straw produced the highest yield per plot of okra (19.21 kg), followed by the control treatment (19.17 kg), white mulch (18.37 kg), and black mulch (16.82 kg). Okra yield was significant according to mulching; the higher yield was obtained in transparent plastic followed by black plastic, also straw and control (Adekiya et al., 2017). The yield of okra was increased by 140% in black plastic mulching as compared to the control (bare soil) (Mahadeen, 2014). Summer squash yield has significantly increased as a result of mulching; the highest yield per plant (3.58 kg/plant) came from black plastic mulch (Kumar and Sharma, 2018). In Chile, the control had the lowest fruit production (13.15 tons/ha), while black plastic mulch produced the most fruit weight per hectare (21.3 tons) (Ashrafuzzaman et al., 2011).

5. Conclusions

The results of the experiment revealed that spacing and mulching significantly influenced the growth and development of the okra plants. The highest germination rate and quickest flowering were seen in silver plastic mulch measuring 30*30 cm, which also encouraged taller plants. In contrast to spacing, mulching had a bigger effect on plant height. These results underline how crucial it is to increase plant spacing and implement appropriate mulching techniques to increase okra yield. Exploring additional elements that might optimize the quantity and quality of okra harvests would require more investigation.

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