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Effect of Mulching and Spacing on the Yield Quality of Cabbage (*Brassica Oleracea L*), South West Nigeria

Olagbaiye J. A

Student, Department of Crop Soil and Pest Management,
Federal University of Technology, Akure, Nigeria

Aiyelari. O.P

Professor, Department of Crop, Soil and Pest Management,
Federal University of Technology Akure, Nigeria

Adejoro.S.A

Senior Lecturer, Department of Crop, Soil and Pest Management,
Federal University of Technology, Akure, Nigeria

Abstract:

The experiment was conducted to examine the effects of mulching and spacing on yield quality of cabbage. The objectives were to determine the appropriate spacing for cabbage, know the effect of mulching on yield quality and measure the combine effect of mulching and spacing on yield of cabbage. The experiment was laid out in a 2 x 5 factorial in Randomized Complete Block Design with three replications. The mulch materials used for the experiments were; black polyethene plastic mulch, gliricidia, Elephant grass, Sunflower, and No mulching (control) while the planting spacing used were (45cm x 45cm and 30 cm x 30 cm). Data collected was subjected to analysis of variance (ANOVA) and means separation was done using Duncan Multiple Range Test (DMRT) at 5% probability level. Result obtained revealed that spacing at 45cm gave the best yield quality with fruit weight (114.36g), fruit height (26.47cm) and girth (48.13cm). Black polyethene (BP) gave the best yield fruit weight (1369.76g), fruit height (29.5cm) and girth (52.33cm). The combined effects of mulching and spacing revealed that combined effect of the factors do not have significant effect on the yield quality of cabbage. Based on the findings spacing of 45 by 45cm and black polyethene mulching materials were recommended for optimum yield quality of cabbage in the region.

Keywords: Mulching, spacing, yield, quality and cabbage

1. Introduction

Cabbage is cultivated and consumed worldwide with production estimated to be around 71.8 million tones with major producers being China, India, Russia and South Korea (FAOSTAT, 2017). In Nigeria cabbage is produced all year round in wet and dry seasons using irrigation especially as its consumption is gaining prominence (Grubben and Denton, 2004). The pressure to meet the growing market demand for cabbage require production techniques that will give higher yield within the available land put to its cultivation at relatively lower cost. Among agronomic practices which could bring about increase yield and low production cost are spacing and mulching techniques already in use by the vegetable farmers. Plant spacing is the distance put between one plant and another inter row and intra row which when too dense leads to crop crowding, competition for nutrients, air, moisture, water and affects the size of the cabbage head as well as yield (Cervenski, et al, 2018). However, in economic point of view narrowing spacing gives higher plant population on a plot of land and is reported to give significantly higher net returns compared to wider spacing (Parmar, 2021). Abed et al (2015) pointed that wider spacing of 70cm within row exhibited larger plant weight, number of leaves, head dimension, volume and density compare to spacing of 50cm within row. Sarker et al (2002) opined that the outcome of any spacing depends on several factors including environment, fertilizer dose, nutrient source, cultivar used and soil fertility as the highest marketable yield of cabbage could be produced from the closest spacing. While there may be factors that give different result it is important to have a general recommendation for farmers producing cabbage in specific regions for adoption in other to get maximum returns.

Mulching on the other hand provides of cover for the soil to regulate the moisture around the plant base which also helps build up the soil, prevent leaching and provide optimum temperature for the plant (Buckner, 2019). It could be utilized to help input nutrient and also reduce the effects of weed on the plant especially in the case of organic materials (Lekasi, et al, 2001). Sarker et al, (2003), reported that mulching has no marked effect on harvest index of cabbage but significantly affect plant height, plant spread, leave loose, head diameter, fresh weight and gross yield. Some earlier experiments using organic materials reported that Mulching have significant effect on weed infestation, moisture conservation, growth and yield of cabbage but no significant difference across the different mulching materials (Masarirambi et al, 2013). However, more recent experiments report show that inorganic mulch material such as black

plastic had significant effect on cabbage size and yield compare to organic mulch material such as wheat straw while no mulching gave least output (Chantal, 2021). Although, under greenhouse condition the productivity of cabbage was reported not to be affected by mulching but was efficient in reducing evaporation and increased the efficiency of water usage (Berca et al, 2019). The different application of mulching under different cultivation practices, types, their effects, techniques and advantages in specific situation makes this experiment important to establish the right approach to be recommended to cabbage farmers in the South West Nigeria who have recently taken an interest into commercial cabbage production (Agri farming, 2021).

2. Materials and Methods

The experiment was conducted at the Teaching and Research Farm of the Federal University of Technology Akure, Ondo State in the rainforest zone of Southwest Nigeria, during two separate periods (early rain and late rain of 2020). Cabbage seed were purchased at Agric Tech Agro shop in Ojoo, Ibadan, Oyo State.

The experiment was a 2 x 5 factorial experiment laid out in a Randomized Complete Block Design (RCBD) with three replications. The mulch materials used for the experiments were: plastic (polyethene) mulch, Elephant grass, Sunflower, Gliricidia leaves and No mulching (Control). Each plot size was 1 m by 2m while plant spacing used was 45 cm x 45 cm and 30 cm x 30 cm.

Data was collected on weight of fruit (g), fruit height (cm) and girth (cm) for analysis.

The data collected were subjected to analysis of variance (ANOVA) using Statistical Package for Social Sciences (SPSS). The treatment means that were significantly different at 5% were compared using Duncan's Multiple Range Test (DMRT).

3. Result

3.1. Early Rain Experiment

Mulching	Weight of Fruit (g)	Fruit Height (cm)	Girth (cm)
No mulch	742.65a	21.33a	42.17a
BP	1369.76b	29.50b	52.33c
Sunflower	1015.69ab	27.83b	48.33bc
elephant	866.00ab	26.83b	48.17bc
Glicidia	946.64ab	21.17a	44.00ab

*Table 1: Effects of Different Mulching Materials on Yield Parameters of Cabbage
Mean Followed by the Same Letter in a Column Are Not Significantly Different from
Each Other by Duncan's Multiple Range Test at 5% Level of Probability*

Table 1 shows the result of early rain experiment which is the effects of mulching material on cabbage yield which revealed that black polyethene (BP) mulching material gave significantly higher fruit weight (1369.76g) while no mulch (control) gave the least (742.65g). The result further shows that BP gave the highest fruit height (29.50cm) which was however not significantly different from results of sunflower and elephant grass while glicidia gave the least (21.17cm). Lastly, BP gave a significantly higher girth (52.33cm) while no mulching (control) gave the least (42.17cm).

Spacing	Weight of Fruit (G)	Fruit Height (Cm)	Girth (Cm)
30 Cm	861.93a	24.20a	45.87a
45 Cm	1114.36b	26.47a	48.13a

*Table 2: Effects of Different Spacing on Yield Parameters of Cabbage
Mean Followed by the Same Letter in a Column Are Not Significantly Different from
Each Other by Duncan's Multiple Range Test at 5% Level of Probability*

Table 2 shows result of early rain experiment which is the effects of spacing on yield of cabbage which reveal that spacing at 45cm gave significantly higher fruit weight (1114.36g) while also giving higher fruit height (26.47cm) and girth (48.13cm) which were however not significantly different.

Mulch * Spacing	Weight of fruit (g)	Fruit height (cm)	girth (cm)
No mulch 45cm	619.82a	21.00a	41.00a
No mulch 30cm	580.54a	20.33a	42.67ab
BP. 45cm	1506.63c	29.67b	52.33c
BP 30cm	1232.88abc	29.33b	52.33c
Sunflower 45 cm	1450.84bc	30.00b	49.67bc
Sunflower 30 cm	827.17abc	25.67ab	47.00abc
elephant 30cm	803.58ab	24.00ab	44.00abc
elephant 45cm	928.41abc	29.67b	52.33c
glicidia 45cm	1066.11abc	22.00a	45.33abc
glicidia 30cm	865.48abc	21.67a	43.33ab

*Table 3: Combine Effects of Different Spacing and Mulching Materials on Yield Parameters of Cabbage
Mean Followed by the Same Letter in A Column Are Not Significantly Different from Each Other by
Duncan's Multiple Range Test at 5% Level of Probability*

Table 3 shows result of early rain experiment which is the combine effects of mulching and spacing on yield of cabbage which reveals that BP-45cm gave significantly higher fruit weight (1506.63g) while no mulching-45cm (control) gave the least (619.82g). Also, sunflower-45cm gave the highest fruit height (30.00cm) which was not however significantly different from elephant grass-45cm, BP-30cm and BP-45cm while no mulching-30cm gave the least fruit height (20.33cm). Lastly, BP-30cm, BP-45cm and elephant grass -45cm gave significantly higher girth of 52.33cm each while no mulching-45 gave the least (41.00cm).

3.2. Late Rain Experiment

Mulching	Weight of Fruit (g)	Fruit Height (cm)	Girth (cm)
BP	1865.50d	22.00b	36.33b
Sunflower	842.00b	16.33a	29.33a
elephant	477.50a	17.33a	30.67a
no mulch	1397.50c	17.50a	32.17ab
Glicidia	1515.50c	17.67a	32.67ab

*Table 4: Effects of Different Mulching Materials on Yield Parameters of Cabbage
Mean Followed by the Same Letter in a Column Are Not Significantly Different from
Each Other by Duncan's Multiple Range Test at 5% Level of Probability*

Table 4 shows result of late rain experiment which is the effects of mulching materials on yield parameters of cabbage. BP gave a significantly higher fruit weight (1865.5g) while elephant grass gave the least fruit weight (477.50g). Also, BP gave significantly higher fruit height (22.00cm) while sunflower gave the least (16.33cm). Lastly, BP gave significantly wider girth (36.33cm) while sunflower gave the least (29.33cm).

Spacing	Weight of Fruit (g)	Fruit Height (cm)	Girth (cm)
30 cm	1156.80a	18.00a	32.00a
45 cm	1282.40b	18.33a	32.47a

*Table 5: Effects of Different Spacing on Yield Parameters of Cabbage
Mean Followed by the Same Letter in a Column Are Not Significantly Different from Each
Other by Duncan's Multiple Range Test at 5% Level of Probability*

Table 5 shows result of late rain experiment which is the effects of different spacing on yield parameter of cabbage. Spacing at 45cm produced significantly higher fruit weight (1282.40g) but significantly indifferent fruit height (18.33cm) and girth (32.47cm).

Mulching * Spacing	Weight of Fruit (g)	Fruit Height (cm)	Girth (cm)
BP. 45cm	1909.00d	21.33bc	36.67c
BP 30cm	1822.00d	22.67c	36.00b
Sunflower 45 cm	908.00b	17.67ab	30.67abc
Sunflower 30 cm	776.00b	15.00a	28.00a
elephant 30cm	1125.00bc	16.33a	29.33ab
elephant 45cm	1670.00	18.33abc	32.00abc
no mulch 45cm	800.00b	17.67ab	31.33abc
no mulch 30cm	155.00a	17.33ab	33.00abc
glicidia 45cm	1125.00bc	16.67a	31.67abc
glicidia 30cm	1906.00d	18.67abc	33.67abc

*Table 6: Combine Effects of Different Spacing and Mulching Materials on Yield Parameters of Cabbage
Mean Followed by the Same Letter in a Column Are Not Significantly Different from Each
Other by Duncan's Multiple Range Test at 5% Level of Probability*

Table 6 shows result of late rain experiment which is the combined effects of spacing and mulching on yield parameter of cabbage. BP-45cm gave higher fruit weight (1909.0g) which was not significantly different from glicidia-30cm (1906.0g) and BP-30cm (1822.0g) while no mulching-30cm gave the least (155.0g). BP-30cm gave a significantly higher fruit height (22.69cm) while sunflower-30cm gave the least fruit height (15.00cm). Lastly, BP-45cm gave a significantly wider girth (36.67cm) while sunflower-30cm gave the least girth (28.00cm).

4. Discussion

The experiment has being able to bring to light the effects of mulching and spacing across different planting periods. Mulching from the findings has a significant effect on fruit weight, fruit height and girth which is in conformity with findings of Sarker et al, (2003) that mulching has effects on yield quality of cabbage. The result equally further agrees with report of Chantal (2021) that when inorganic mulching material in this case black polyethene is put to use it significantly gives a higher yield in cabbage. In addition the overall yield of cabbage in early rain is better in height and girth (diameter) even though it weighs lower. The implication of this finding is that mulching is very important as a

cultural practice when cultivating cabbage and the choice of black polyethene gives higher yield compares to organic mulching materials.

Wider Spacing in the production of cabbage is very important from the finding of this experiment which gave higher overall yield with 45cm especially with the fruit height and girth (diameter) which conforms to report of Abed et al (2015) who got better yield with even spacing of 70cm. Also, the performance in early rain was also better. This implies that the wider the spacing in cabbage cultivation the better the yield. This however would not be economically good where there is a limited land resource for use as the overall number of output per land will be lower.

The combined effect of mulching and spacing reveal that use of black polyethene at a spacing of 45cm gave the highest fruit weight in both the early and late rain experiment however best fruit height and girth were obtained from sunflower at spacing of 45cm and black polyethene at spacing of 30cm conforming with report of Sarker (2003) that these do not have an effect on the harvest index of cabbage. This implication for this finding is that spacing and mulching are not solely be factors that will influence yield quality of cabbage.

5. Conclusion

The yield of cabbage which is an important component in its cultivation has been found to be influenced not only by mulching and spacing but also by other factors not studied in this research as seen in the findings of this experiment. It is important that several cultural practices should be also put in place in order to obtain high yield and overall harvest index in the cultivation of cabbage by the South West vegetable farmers in Nigeria.

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