Effect of Basal Density of Mulched Materials on the Growth and Fruiting Performance of Table Banana (Latundan var.)

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Abstract - *This experiment aimed to find out the effect of basal thickness of mulched materials on the growth and fruiting performance of table banana (Latundan var.). The experimental field was a portion of an existing table banana plantation. It was laid out using Randomized Complete Block Designwith three replications. The four treatments were designated as follows: T_0 (control - no mulch applied); T_1 (applied with 15-cm thick mulch); T_2 (applied with 30-cm thick mulch); and T_3 (applied with 45-cm thick mulch). Results showed that table banana clumps mulched with organic materials at 30-cm thick appeared most favorable with the highest increase in plant height (319 cm) and number of suckers produced (4.25). The highest weight of fruit bunch and fruit hand were obtained by plants mulched at 45-cm thick with weights of 6.64 kg and 0.87 kg, respectively. The above findings were statistically significant from the control treatment.*

Keywords: banana fruiting, fruiting performance, growth performance, mulching, mulching thickness, organic fertilization

INTRODUCTION

Mulching is a process of overlayingmaterial usually organic residueson the ground surface in order to conserve moisture, control weed growth and provide organic matter to the plant. It is especially important to be done during periods of the year when rainfall occurrence is lean or when the area is prone to runoff [1]. Because of improved moisture and lesser competition of nutrients, the application of mulch on the base of a plant promotesa favorable environment for better growth. Such an enhanced condition could bring about positive effects on vital agronomic parameters like plant height, stem size, number of leaves, leaf length, leaf width, number of suckers, and fruit yield.But even if the area is receiving sufficient rainfall, mulching is still good to be done because it will limit the growth of weeds on the base of the banana clump.

This study looked into the basal density of the applied mulches vis-à-vis their effect on selected agronomic and yield parameters of table banana (Latundanvar). Though some studies on mulching exist, there was no study yet done that probe into the effect of basal density of the applied mulching materials on the growth and fruiting performance of table banana (Latundan var.).The spreading over of organic mulches on the base of banana clumps instead of throwing them away or worse by burning them is considered environment-friendly thus sustainable.Table banana is one of the crop commodities that plays a big contribution to the Philippine economy because it is consumed both locally and abroad[2].

A research on the leaf concentration of three banana cultivars (Jahaji, Chenichampa and Manohar) as affected by different organic mulches (paddy straw, paddy husk, and water hyacinth) showed thatthe organic mulches promoted the increase in the amount of total nitrogen, phosphorus and potassium concentration of the banana leaves[3].

A mulching study of white potato revealed that plants mulched with rice hay, banana and cogon emerged much earlier than the unmulched plants [4].While a mulching and intercropping of upland taro have shown a higher yield of mulched taro compared to unmulched ones despite effective weed control of the unmulched treatment [5].

McIntyre et al. [6] [7]on the effect of mulching on the biomass of banana revealed that mulched treatments produced three times more biomass than

bare soil treatments. The increase in biomass due tomulching has resulted to improvedsoil fertility. They further noted that mulched treatments had higher concentrations of soil organic carbon, phosphorus, potassium, and magnesium. A follow-up study has reported that in spite of the higher weevildamage, mulched treatments still yielded significantly heavier bunches. Thus, the effects of mulching prevailed over the injurious damage of banana weevil.

A parallel finding was obtained in Gandhi and Bains [8] on the effect of mulching and date of transplanting on the yield of tomato planted during cold months. Results showed that the number of branches, average fruit weight and total yield were maximum under the transparent polythene mulch followed by black polythene, straw mulch and control.

Philippines has a significantly wide area planted to table bananas, hence finding alternative ways of improving production such as the application of mulches is a goodresearch agenda.

OBJECTIVES OF THE STUDY

This research has the following objectives:

1. Find out the effect of basal density of mulched materials on selected agronomic parameters of table banana (Latundan var.).
2. Determine the effect of basal density of mulched materials on the fruit yield of table banana (Latundan var.).

MATERIALS AND METHODS

Site identification/characterization. This study was conducted in Biliran, Philippines on a portion of an existing one-hectare table banana plantation. Such area was chosen as experimental locale due to its accessibility. The site is plain with silty clay loam soil. During the experiment (November 2013 to October 2014), the area received very little rainfall due to El Niño phenomenon which occurred in the area.

Experimental design and layout. The experimental area measuring 1,024sq m was laid out using the Randomized Complete Block Design (RCBD) with four (4) replications. Sixteen banana clumpsspaced at 8m x 8mwere used asthe experimental plants. Each clumphasa basal size of 4sq m.The treatments are:

T_0 = control (no mulch materials)
T_1 = with 15-cm high mulchmoderately-pressed on the base
T_2 = with 30-cm high mulchmoderately-pressed on the base
T_3 = with 45-cm high mulchmoderately-pressed on the base

Application of mulching materials. Grasses and organic residues of same nature taken from the surrounding areas were applied at different density(thickness) by moderately-pressingthem around every clump about 1-meter from the base.

Cleaning the experimental area. Weeding the experimental area was done every two weeks to maintain the cleanliness of the surroundings, particularly the control (no mulch treatment).

Trimming of old leaves. Old banana leaves that have turned yellow or brown wereoccasionally removed to improve the stand of the crop.

Cutting of excess suckers. Plant number per clump was maintained at 5 big plants and 5 suckers per clump only. Excess suckers were cut down after they have been properly recorded. The smallest suckers were the ones removed.

Harvesting of fruits. Banana fruit bunch was harvested when about 90% of the fingers werealready mature.

Data Analysis. Analysis of Variance (ANOVA) using SPSS was used in determining whether significant differences exist among treatments, while LSD was used to find specific differences between pair of means.

Data Gathered

Initial plant height (cm). The initial plant heights (from the base up to the shoot) of the test plants were measured in order to serve as point of reference for the succeeding measurements.

*Monthly increase in stem height (cm).*Monthly increases in stem heights in all treatments were measured to monitor the treatment effects on plant growth.

*Plant height at harvest time (cm).*This was taken at harvesting time by measuring the length from the ground up to the tip of base of the youngest shoot.

Stem circumference of adult plant (cm). This was taken prior to harvesting by measuring the circumference of the banana stem at two feet above the ground.

Number of leaves per plant. The total number of leaves per plant were notedfrom the time it produced the first true leaf up to the time of harvest.

Length of leaves (cm). Three longest mature leaves of the experimental plants in every clump were measured at harvest time. Monthly data was not taken for this parameterbecause the plants were tall and measurements could have high inaccuracies.

Width of leaves (cm). Three widest mature leaves of the experimental plants in every clump were measured at harvest time. Also, no monthly data was taken for this parameter for same reason as above-stated.

Number of sucker sprouts per month. All sucker sprouts every month were counted, but some were cut down in pursuance of the maximum five suckers per clump limit.

Weight of fruit bunch (kg). The weight of the whole fruit bunch was taken by using only one standard weighing scale.

No. of hands per bunch. The number of fully-developed hands per bunch was counted and recorded.

Weight of oldest hand per bunch (kg). The oldest hand in every bunch was removed using a uniform style, then weighed and recorded.

RESULTS AND DISCUSSION

The initial height of banana suckers for the control treatment (176 cm) showed to be tallest which was statistically different from the other treatments at the onset of the experiment (Table 1). But at harvest time, the plant height in the control treatment (T_0 – no mulch) showed the lowest increase in height (215 cm), followed by T_1 (15-cm mulch) at 271 cm, T_3 (30-cm mulch) at 302 cm and T_2 (45-cm mulch) at 319 cm. However, the plant heights of T_2 and T_3 are not statistically different. A similar trend of result with the above was observed in the leaf length.

While the leaf widths of T_0, T_1, and T_2 (54 cm, 58 cm, and 58 cm, respectively) showed no statistical difference from each other. These leaf widths however were statistically different from T_3 with 67 cm. Stem circumference of adult plant were almost statistically the same for all treatments except in the control (T_0), which was the smallest of all treatments. The number of leaves per plant did not bare any difference in all the treatments (Table 1).

Based on the results, it could be gleaned that the application of mulching materials at the base of the clump at different density could bring about significant effects on the agronomic parameters of the banana plants. These marked differences in some of the agronomic characteristics measured could be attributed to mulching.

Table 1: Agronomic characteristics of table banana (Latundanvar.) as affected by the basal density of mulched materials

TREATMENTS	Initial plant height (cm)	Plant height at harvest time (cm)	Stem circumference of adult plant (cm)	No. of leaves per plant	Leaf length (cm)	Leaf Width (cm)
T_0 = control (no mulch materials applied)	176 b	215c	43b	20	183 c	54b
T_1 = with 15-cm high mulch materials applied on the base	154 a	271b	53 a	29	204 b	58 b
T_2 = with 30-cm high mulch materials applied on the base	153 a	319 a	54 a	30	220 a	58 b
T_3 = with 45-cm high mulch materials applied on the base	152 a	302 a	57 a	30	219 a	67 a
S.E.	8.08	10.45	1.49	0.70	3.40	1.36
CV (%)	5.10	3.80	2.90	2.50	0.40	2.30
p-value	0.008*	0.000*	0.000*	0.129	0.000*	0.000*

Means with a common letter within a column are not significantly different at 0.05 level of significance based on ANOVA and LSD.

Mulching may have effectively provided a favorable physical condition for the growth of banana plants. This assertion is supported in Afrifa et al. [9] on the effects of mulching on the yield of Robusta coffee. Their results showed that coffee yield has been significantly higher in those plants with mulched materials.

The above statement was also sustained by the findings in Mal et al. [10]on the effect of mulching in pomegranate. Here, maximum increase in plant height (14.9%) and basal girth (13.1%) were recorded with dry leaves and banana leaves used as mulches, respectively.

The monthly increase in stem height and sucker production revealed no significant differences among treatments until the sixth and seventh month of the experiment, respectively. Significant differences in stem height was found on the sixth, seventh and eighth month of measurement (245 cm, 252 cm, and 263 cm) where T_2got the tallest stem height. Plants on T_3 obtained the next highest stem heights relative to the thickness of mulch materials at 224 cm, 234 cm, and 248 cm on the same time interval.

On the other hand, sucker sprouts showed significant differences across treatments based on LSD on the seventh and eighth month of mulching. Treatment 2 obtained the most number of suckers of 4.25 followed by T_3, T_1 and T_0 of 4.00, 2.50, and 0.50 respectively. A similar trend in sucker production was observed on the eighth month but with comparatively fewer number of sucker sprouts (Table 2).

Results showed that thickness of mulching materials had both a positive and negative effect on stem height and on sucker production. When no mulch is applied (T_0) or were thinly applied (T_1) or thickly (T_3),the increase in stem height and sucker production were lower than when mulches were applied in moderation (T_2). The beneficial effects of mulched materials on stem height and sucker production of table banana is highly attributable to their varying density (thickness) which necessarily saved soil moisture plus minimal weed competition.

The recent result in Dipika et al. [11]on the effect of mulching on the growth and flowering of gerbera, though using a synthetic mulching material(black polyethylene) is comparable to this study because both have shown that mulching produced the tallest plant with the most number of suckers per clump.

Table 2: Monthly increase in stemheight and sucker sprouts of table banana (Latundan var.)as affected by the basal density of mulched materials

TREATMENTS	**Monthly Increase inStem Height (cm), (above data) Number of Sucker Sprouts Per Month, (below data)**							
	1st	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**
T_0 = control (no mulch materials applied)	108 1.75	116 0.50	128 1.25	136 0.25	145 1.00	162 c 1.75	169 c 0.50 c	177 c 0.50 b
T_1 = with 15-cm high mulch materials applied on the base	152 1.25	161 1.50	178 2.50	185 1.00	191 2.75	210 b 5.00	216 b 2.50 b	224 b 1.00 b
T_2 = with 30-cm high mulch materials applied on the base	158 1.00	167 1.50	200 2.75	212 0.75	222 2.75	245 a 4.25	252 a 4.25a	263 a 3.50 a
T_3 = with 45-cm high mulch materials applied on the base	157 0.75	162 1.50	183 2.00	194 1.00	199 2.50	224 a 4.00	234a 4.00a	248 a 3.25 a
S.E.	7.38 0.26	7.37 0.27	9.10 0.33	9.71 0.14	9.63 0.28	9.89 0.55	9.80 0.45	9.99 0.41
CV (%)	5.10 21.8	4.90 21.6	5.30 15.5	5.30 18.7	5.10 12.4	4.70 14.7	4.50 16.0	4.40 19.9
p-value	0.026 0.619	0.025 0.490	0.014 0.416	0.017 0.217	0.016 0.060	0.006* 0.184	0.004* 0.001 *	0.001* 0.002*

Means with a common letter within a column are not significantly different at 0.05 level of significance based on ANOVA and LSD.

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Table 3: Yield parameters of table banana (Latundanvar.) as affected by the basal density of mulched materials

TREATMENTS	No. of Hands Per Fruit Bunch	Weight of Fruit Bunch (kg)	Weight of Oldest Hand Per Bunch (kg)
T_0 = control (no mulch materials applied)	5.00	4.94b	0.66 b
T_1 = with 15-cm high mulch materials applied on the base	5.50	5.47 b	0.77 a
T_2 = with 30-cm high mulch materials applied on the base	5.50	6.39 a	0.79 a
T_3 = with 45-cm high mulch materials applied on the base	6.25	6.64 a	0.87 a
S.E.	0.81	0.18	0.25
CV (%)	14.60	3.10	32.50
p-value	0.094	0.000*	0.008*

Means with a common letter within a column are not significantly different at 0.05 level of significance based on ANOVA and LSD.

Yield data revealed no significant differences on the number of hands per fruit bunch. However, the weight of fruit bunch as well as the weight of oldest hand per bunch did show substantial differences (Table 3).

The heaviest fruit bunch weighing 6.64 kg and fruit hand weighing 0.87 kg was obtained in T_3. It was followed by T_2 weighing 6.39 kg fruit bunch and 0.79 kg fruit hand. T_1 and T_0 got the lowest weights of the above-mentioned parameters. Although the highest weight of fruit bunch was observed in T_3, it was not statistically different from T_2. Fruit bunch weights of T_1 and T_0 were also not statistically different from each other. While the weight of oldest fruit hand was not statistically different for all the treatments, except in T_0.

The yield data showed that table banana fruiting can be affected by the application of mulched materials at different density or thickness. ThoughT_3 got the highest weights of fruit bunch and oldest hand per bunch, the same were not statistically different from T_2. This implies that mulched materials applied at 30-cm high is the favorable density of mulching application for table banana (Latundan var.). This finding is backed up by the result in Singh Gorakh[12]on the impact of mulches in meadow orchard of guava. Here among the organic mulches, the fruit yield was maximum (12.5 kg/plant or 62.5 tons/ha) in plants mulched with banana leaf followed by paddy straw and grass mulches (12.4 kg/plant or 62.0 tons/ha). The plants without mulch had produced 12.0 kg/plant or 60 tons/ha. Heaviest fruit (250 g) was obtained from banana leaf mulched followed by polyethylene mulched film (225 g).

Moreover Ssali et al. [13] on the effects of mulch and mineral fertilizer in highland bananafound that banana yield was significantly higher in the sole mulch treatment than in the control. The researchers foundthat combining mineral fertilizer with mulch established no demonstrable advantage to sole mulch.

CONCLUSION

Mulching of organic residues at a density (thickness) of 30-45 cm is morebeneficial for the growth and fruiting performance of table banana (Latundan var.)as well as the production of healthy suckers.Too much application of organic mulches to banana clumps, i.e., more than 45-cm thick, tends to reduce thenumber of suckers coming out from the base. Thicker mulch mayincrease the basal temperature which could make the condition unfavorable for the banana suckers to come out from the clump.

RECOMMENDATION

This study was conducted during a period when the surroundings was generally dry because of El Niño phenomenon which occurred in the area. Thus,a similar study done during rainy season may be conducted, to compare the effects of basal density of mulched materials on the agronomic and yield parameters of bananaapplied during dry and wet seasons.

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