Response Of Sugarcane (VMC 599) As Affected By The Application Of Different Levels Of Mud Press And Bagasse Compost

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Abstract
This study focused mainly on the response of sugarcane (VMC 599) applied with different levels of mud press and bagasse compost. Specifically, it aimed to 1) determine which among the different levels of mud press and bagasse compost would be the best in terms of a) plant height at maturity (cm), b) number of tillers, c) diameter of stalks (cm), d) length of internodes and e) sugar content per tons of cane and to 2) determine the cost and return the different treatment tested.

The Randomized Complete Block (RCB) design was used in the experiment to test the following treatments: T1- Recommendation rate, T2- Pure Bagasse, T3- Pure Mud press, T4- 75% Mud press + 25% Bagasse, T5- 50% Mud press + 50% Bagasse, and T6- 25% Mud press + 75% Bagasse. Based on the result, the application of recommended fertilizer rate on the production of sugarcane produced the tallest plants; however, it has no significant difference with the application of combined bagasse and mud press in other growth and yield parameters such as the diameter of the plant, tiller number per hill and the amount of sugar per ton of cane. The application of recommended fertilizer can be adopted; however, different levels of bagasse and mud press may still be considered since it has almost the same effect in terms of sugarcane agronomic and yield characteristics.

Introduction

The continues rise in the human population also requires for higher number of basic necessities such as food, shelter, clothing and even medicine. Philippines is considered an agricultural country yet the production is still below the sustainability line thus the government were forced to import goods to maintain the demand and needs of the increasing population. The issue on land conversion, continues monocropping and other ill practices in farming had greatly affected the overall performance of the Philippine agriculture yet the country is endowed with many natural resources. The above problems must be addressed the soonest possible so that we could limit the importation of goods form other countries and to sustain the needs of the growing population.

There are many factors that may influence the overall performance of crops and to mention some, crops should be provided with right and adequate amount of fertilizers and must be raised using the latest technology in the production of specific crop. Fertilizers are considered to be indispensable in agricultural production. This means that the crop cannot give the potential yield if the productivity level is below the requirement. Nutrient should be made available during the different plant growth and must be in its absorbable form so that plant would not exert too much energy in the absorption process. This is one of the unique characteristics of inorganic fertilizers thus making it the most in-demand agro-chemical used in farming. Moreover, synthetic fertilizers also have high nutrient composition as compared to organic fertilizer or compost.

On the other hand, excessive usage of synthetically produced agro-chemicals had brought deleterious effect on the soil's natural fertility and health. Excessive application of synthetic fertilizer may also cause nutrient toxicity, soil degradation and even environmental pollution. In order to minimize the usage of synthetic fertilizers, decomposed chicken dung, cow manure, other animal excreta and decomposed plant waste can be applied. Other farmers also practice the use of vermi compost and vermi tea in fertilizing their crops. However, some of the disadvantage in using organic fertilizer not easily absorbed by plants because it still needs microorganism to degrade them into its absorbable form. Another problem with the use of organic fertilizer is that, proximate analysis varies based on the substrates used in the production.

Balance fertilization must be adopted by every farmer in the entire world so that they could provide the needs of the crop in its entire growth. Furthermore, there will be no excess application of fertilizer and other agro-chemical that may harm the environment. Under the implementing rules and regulations of Republic Act 10068, farmers must adopt organic farming by considering the transition phase, this scenario will give ample time for the soil to recover form nutrient degradation caused by improper application of fertilizer over the past years.

In the milling district, the main concern is the disposal of waste such as filter cake/mud cake, bagasse, mud press, and sugarcane spent wash which when not treated properly, may cause deleterious effect on the environment. Sugarcane is a

long-duration cash crop categorized under exhaustive crop (*Paul et al., 2005*). The said crop requires high requirements of micro and macro-nutrients for proper growth and development. The crop is a heavy feeder; it can remove as high as 140-34-332 kg of NPK/ha from the soil when producing100 tons in a hectare of land (*Bokhtair et al., 2001*), Thus, optimum fertilizer requirement should be given in the growing crops. High nutrient requirements for the fertilization of sugarcane cause an additional burden on the farmers since most of them rely only upon the use of commercial fertilizers hence, to cut their agony, use of alternate nutrient sources should be provided such as mud press and bagasse. According to the study conducted by *Dotaniya et al., (2016)*, the application of mud press and bagasse improves soil chemical, physical, and biological properties and enhances crop quality and yield. Mud press and sugarcane bagasse are considered soil ameliorants and can be enhanced through the process of composting. At present, there are no published articles as to the optimum quantity of sugarcane bagasse and mud press needed to meet the crop's maximum possible yield expressed in tons/ha.

This paper was then designed to assess the response of sugarcane applied with different levels of mud press and compost, hence this paper.

Objectives of the Study
Generally, the study aimed to determine the response of sugarcane (VMC 599) applied with different levels of mud press and compost.

Specifically, it aimed to:
a. Determine which among the different levels of mud press and bagasse would be the best in terms of:
a. height of Plants (cm) at maturity
b. number of tillers per hill
c. Length of internodes
d. Number of nodes
e. Diameter of stalks
f. Theoretical Sugar Yield per ton of cane
b. Determine the economics of the different treatments tested.

Scope and Delimitation
The study was conducted at Cagayan State University Piat Campus (crops experimental farm) from November 2021 to November 2022. It was focused mainly on the agronomic characteristics, theoretical sugar yield and economics of using the different treatments. The study was terminated after 1 cropping season.

METHODOLOGY
Materials
The following materials were used in the experiment: sugarcane seed pieces as planting material (VMC 599), fertilizers (organic and inorganic fertilizers), liming material (calcium carbonate and filter cake), measuring devices (sensitive weighing balance, meter stick or tape measure, ruler), record book, pen, placards and string.

Soil Sampling
Soil samples were randomly selected and gathered in zigzag orientation in the experimental area at one (1) kilogram per sampling site. Soil samples were mixed together, air dried for three days and sieved in fine mesh net prior to submission to DA-CVIAL (Department of Agriculture- Cagayan Valley Integrated Laboratory) for nutrient analysis.

Experimental Design and Procedures
The Randomized Complete Block Design (RCBD) with three replications was used in the experiment. The treatments were as follows:
Treatment 1- Recommendation Rate
Treatment 2- Pure Bagasse
Treatment 3- Pure Mud press
Treatment 4- 75% Mud press + 25% Bagasse
Treatment 5- 50% Mud press + 50% Bagasse
Treatment 6- 25% Mud press + 25% Bagasse

Plot size of 8 meters x 3.5 meters was used per treatment. An alleyway of two (2) meters in between treatments and replication was also observed.

Land Preparation
A total area of 990 square meters was prepared three weeks before the conduct of the study. This was done by two (2) ploughings and one (1) harrowing to allow weed seeds to germinate and to incorporate dried weeds and crop stubbles in the soil to hasten decomposition.

Preparation of Planting Materials
Sugarcane cuttings used in the experiment was about nine (9) months old and were taken from the plants with good vegetative growth, complete tiller and were free form pest and diseases. Sugarcane stalls were cut into seed pieces with three healthy buds. Seed pieces were treated by submerging them in luke warm water for tow (2) hours to prevent disease and insect to get in contact with the planting materials.

Furrowing
Furrows were made prior to planting at one (1) meter apart using animal drawn plow.

Planting
Sugarcane seed pieces were planted along the furrows at 50 cm apart. The planting materials were covered with soil to hasten the production of roots.

Watering
Newly planted cane was irrigated with an equal amount of water early in the morning or late in the afternoon to ensure good germination. Watering was also done as the need arises.

Securing of bagasse and mud press
Mud press and sugarcane bagasse are rich in macro and micro nutrients but must undergo thorough decomposition to ensure that the said material can be used as organic material. During the conduct of the experiment, fully decomposed mud press and bagasse were hauled from a well-known farm at Sto Domingo Piat Cagayan. It should be mentioned that the said materials were dumped in the different farms and was not used until full decomposition has been observed since said materials release high amount of toxic substances such as methane that can cause deleterious effect on the growth and development of crops.

Fertilizer Management
All organic fertilizers (mud press and bagasse) were applied basally. The amount of inorganic fertilizer was based from the result of the soil analysis. Split application of inorganic fertilizer was made during planting and 45 days thereafter with 4.3 bags of 14-14-14, 1 bag of 16-20-0, and 1.5 bags of 46-0-0 of inorganic fertilizers. The reaming 3.3 bags of 46-0-0 was applied 60 days after planting

Harvesting
Harvesting was done when sugarcane stalks reached its maturity (at least 11 months from planting) leaving one (1) inch of the stalk above the ground. Defoliation was made prior to cutting of stalks. Stalks were piled and bound to give ease in loading the harvested stalks.

Statistical Analysis
All data were analyzed using the Statistical Tool for Agricultural Research (STAR). Analysis of Variance (ANOVA) and the least significant difference at 5% and 1% level was used to determine the significance of the treatments used in the experiment..

Data Gathered
1. Plant height- this was taken by measuring the plant height starting from the base of the plant up to the tip of the leaf sheath before harvesting
2. Number of tillers per hill- this was done by counting the tillers of all representative sample plants. The total number of tillers were divided to the total number of representative samples.
3. Length of internodes – this was taken by measuring the internodes of sugarcane stalks from bottom, middle, and upper most part of the stalk using a meter stick. The total length of stalks from the bottom, middle and upper part was divided into three (3) to get the average. The total average length of internodes of all representative samples were divided to the length of internodes to get its mean.
4. Diameter of stalk- this data was taken by measuring the diameter of sugarcane stalk from the bottom, middle, and upper most part of the stalk using a Vernier caliper. The total diameter of stalks from the bottom, middle and upper part was divided into three (3) to get the average. The total average diameters of all representative sample stalks was divided to the number of stalks to get the mean diameter. The mean can be computed by dividing the summation of the diameter over the total number of representative samples.
5. Theoretical Sugar content- this was determined by extracting sugarcane juice using a juicer and subjected to sugar content evaluation using a sucrose meter.

RESULTS AND DISCUSSION
General Observation
During the conduct of the experiment, the environment is conducive to the production of sugarcane because irrigation is not a problem. During the dry months, intermittent irrigation was observed by applying water in furrows, however, to minimize experimental error, dikes was made within subplots to avoid leaching of fertilizer material. In addition, pests

and diseases were strictly monitored through the visual method. Application of ALTAP following the recommendation rate stipulated in the manufactures manual was followed to control the insect in the area. The application was only made once during the entire study period. Destructive sampling was also made in the sampling area for the assessment of sugar content

Plant Height

Figure 1 shows the height of the plant as affected by the application of sugarcane bagasse and mud press compost. Based on the result, highly significant differences existed among the different treatments tested. Plants applied with recommendation rate (T1) recorded the tallest plant of 356.57 cm followed by plants applied with pure mud press compost (T3) and combinations of 75% mud press and 25% bagasse (T4) with 350.90 cm, and 345.90 cm respectively. Plants applied with equal proportions of mud press and bagasse compost (T5) attained a mean height of 338.17 cm while plants applied with 25% mud press and 75% bagasse (T6) recorded a mean height of 328.03 cm. The shortest plants was recorded by those applied with pure bagasse compost with 300.40 cm. Results implies that sugarcane applied with the recommended rate of NPK is still the best treatment in tersm of height. This finding jives with the report of Majidano *et al.,* (2003) and Mehboob *et al.,*(2000) stating that tallest cane was obtained with the application of recommended NPK (200–80–160 kg/ha) from inorganic source. Hofsetz and Silva (2012) also claimed that the application of bagasse and mud press helps increased the growth of plants since said waste are rich of organic fertilizers specifically when they undergo thorough decomposition.

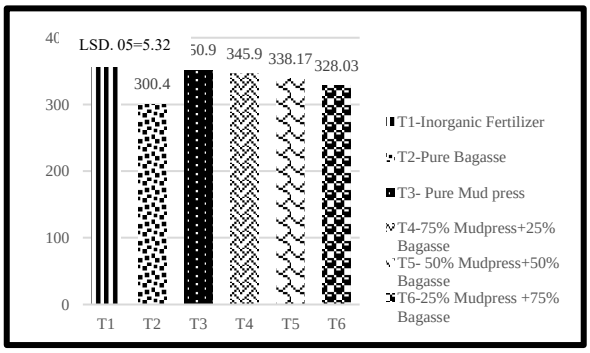

Figure l. Average plant height (cm) of sugarcane as affected by the application of inorganic fertilizers and different levels of mud press and bagasse

Number of tillers per hill

Figure 2 shows the number of tillers of the sugarcane as effected by the application of sugarcane bagasse and mud press compost. Based on the result of the analysis of variance, no significant differences existed among the different treatments tested. This only means that despite different fertilizer were applied to sugarcane, the production of tillers still ranges from 3-4 per plant.

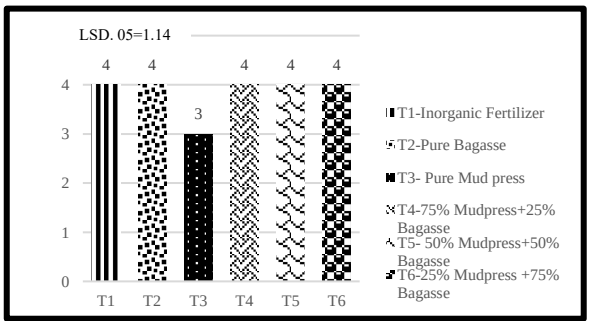

Figure 2. Average tiller numbers of sugarcane as affected by the application of inorganic fertilizers and different levels of mud press and bagasse

Plant Diameter (cm)

The diameter of the different sugarcane cultivars as affected by the application of sugarcane bagasse and mud press compost is shown in Figure 3. Significant difference existed in the different treatments tested based on the result of the analysis of variance. On comparison among treatments, a significant result could be observed when T_3 and T_1 are compared to T_2 but not significantly different when compared to T_4 and T_5. This only means that the application of recommended rate of inorganic fertilizer, pure mud press and combination of mud press and bagasse facilitates bigger sugarcane diameter compared to plants applied with pure sugarcane bagasse. The result could be explained by Dotaniya *et al.,* (2016) claiming that sugarcane by-products such as press mud and bagasse can improve the physical, biological, and soil properties and increase soil organic matter facilitating the increase in plant growth (height, diameter of stalks,

nodes per plant). In addition, Jatav et al., (2017) reported that municipal solid waste compost and sugarcane press mud compost increase and maintain soil organic matter and plant productivity

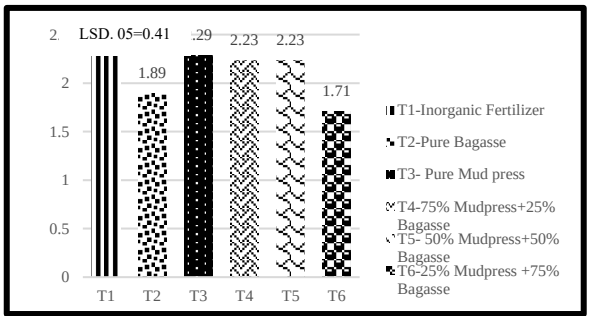

Figure 3. Diameter of the sugarcane as affected by the application of inorganic fertilizers and different levels of mud press and bagasse

Length of Internodes

Figure 4 shows the average length of sugarcane internodes as affected by the application of different levels of mud press and bagasse compost. The longest internodes were observed when plants are applied with Treatment 1 and Treatment 3 with respective means of 20.97 cm and 20.86 cm. The ranking of treatments was closely followed by Treatment 4, Treatment 5, and Treatment 6 with means of 20.58 cm, 20.32 cm, and 19.53 cm respectively. The shortest internodes of 19.37 cm were obtained from plants applied with Treatment 2. This only means that the application of different levels of fertilizer affects the length of the internodes of sugarcane. The result could be explained by Venkatakrishnan and Ravichadran (2013) that the application of mud press along with the application of inorganic fertilizer enhances the growth of sugarcane internodes.

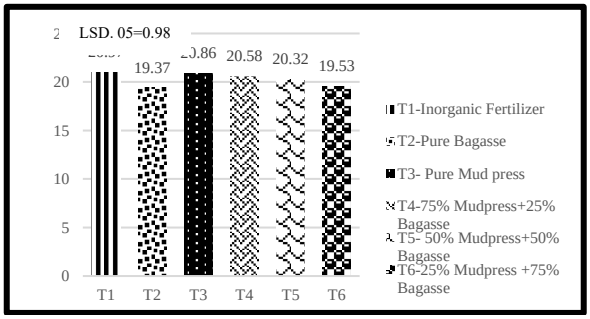

Figure 4. Length of sugarcane internodes as affected by the application of inorganic fertilizers and different levels of mud press and bagasse

Theoretical Sugarcane Yield

Figure 5 shows the sugar produced per ton of cane as affected by the application of sugarcane and mud press compost. The highest sugar produced per ton of cane was observed when plants were applied with 25% mud press and 75% bagasse (T_6) with a mean of 1.91. The ranking was closely followed by plants applied with Pure Mud press (T_3), 75% mud press plus 25% bagasse (T_4), 50% mud press plus 50% bagasse (T_5), and Pure bagasse (T2) with means of 1.90, 1.87, 1.86, and 1.80 respectively. On the other hand, the lowest sugar produced per ton of cane was observed from plants applied recommendation rate (T1) with a recorded mean of 1.72. The low numerical difference permits the crop to have no significant result specifically in this parameter. According to (Venkatakrishnan and Ravichandran 2013) application of mud press and bagasse along with inorganic fertilizers resulted in higher cane yield. Therefore, recycling organic waste by applying to agricultural land seems to be a good option to sort out the waste storage problem and shortage of plant nutrients (*Zaman et al. 2002, 2004*).

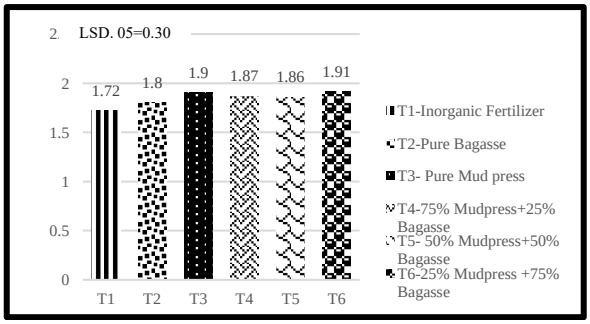

Figure 5. Amount of sugar per ton of can as affected by the application of different fertilizer recommendations.

Cost and Return Analysis

Table 1 shows the cost and return analysis of three sugarcane varieties applied with different levels of mud press and bagasse compost. In terms of the total cost of production, treatment applied with a full recommendation rate of inorganic fertilizer (T1) recorded the highest total cost of production of P147,493.00 while other treatments recorded a total cost of production of P125,736.00. On the other hand, T5 (50% Bagasse and 50% Mud press) recorded the highest sale of P196,588.00 and was closely followed by T2, T1, T6, T4, and T3 with gross sales of P190,071.00, P188,985.00, P186,813.00 and P185,727.00, respectively.

Plants applied with 50% Bagasse and 50% Mud press (T5) recorded the highest net income of P70,851.7 and was followed by plants in T2, T6, T4, T3 and T1 with corresponding net income of P64,335.00, P63,248.9, P61,076.6, P59,990.5 and P41,492.1, respectively. The same ranking of treatments was observed in terms of return on investment. The application of mud press and bagasse on sugarcane cultivars would possibly cut the production inputs of farmers but will not sacrifice the possible yield of the said crop.

Table 1. Cost and Return of Sugarcane (VMC 599) as affected by the application of different levels mudpress and bagasse

Particulars	T1	T2	T3	T4	T5	T6
Planting Materials	18500	18500	18500	18500	18500	18500
Organic Fertilizer	2500	10000	10000	10000	10000	10000
Inorganic Fertilizer	24236					
Herbicides	5220	5220	5220	5220	5220	5220
Land Preparation						
Plowing	2400	2400	2400	2400	2400	2400
Harrowing	2400	2400	2400	2400	2400	2400
Furrowing	1800	1800	1800	1800	1800	1800
Planting (Sugarcane)	4800	4800	4800	4800	4800	4800
Fertilizer Application						
Bagasse and Mud press		8000	8000	8000	8000	8000
Inorganic	8000					
Weeding	1500	1500	1500	1500	1500	1500
Cutting	20500	20500	20500	20500	20500	20500
Hauling	18400	18400	18400	18400	18400	18400
Irrigation	3200	3200	3200	3200	3200	3200
Total Inputs	113456	96720	96720	96720	96720	96720
B. Miscellaneous	34036.8	29016	29016	29016	29016	29016
C. Total Cost of Production	147493	125736	125736	125736	125736	125736
D. Gross Sales	188985	190071	185727	186813	196588	188985
E. Net Income	41492.1	64335	59990.5	61076.6	70851.7	63248.9
F. Return of Investment	28.13	51.17	47.71	48.58	56.35	50.30

SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted at Cagayan State University Piat, Baung, Piat, Cagayan experimental area from November 2021 to October 2022. The study focused mainly on the response of sugarcane (VMC 599) applied with different levels of mud press and bagasse compost. Specifically, it aimed to 1) determine which among the different levels of mud press and bagasse compost would be the best in terms of a) plant height at maturity (cm), b) number of tillers, c) diameter of stalks (cm), d) length of internodes and e) sugar content per tons of cane and to 2) determine the cost and return the different treatment tested.

The Randomized Complete Block (RCB) design was used in the experiment. The following treatments which were replicated three (3) times were as follows: T1- Recommendation rate, T2- Pure Bagasse, T3- Pure Mud press, T4- 75% Mud press + 25% Bagasse, T5- 50% Mud press + 50% Bagasse, and T6- 25% Mud press + 75% Bagasse.

Based on the result, significant result was observed when inorganic fertilizer was applied to sugarcane specifically on plant height at maturity (330.6 cm). In addition, T1 (inorganic fertilizer) still recorded the longest plant diameter but was not significantly different from plants applied with pure mud press. The number of tillers and the sugar per ton of cane were not affected since no significant difference existed based on the result of the analysis of variance. The result implies that the application of mud press and bagasse in the production of VMC 599 produced the same yield when applied with pure inorganic fertilizer.

Conclusion

Based on the findings, it was concluded that the application of recommended fertilizer rate on the production of sugarcane produced the tallest plants; however, it has no significant difference with the application of combined bagasse and mud press in other growth and yield parameters such as the diameter of the plant, tiller number per hill and the amount of sugar per ton of cane.

Recommendation

Based on the above result, the application of recommended fertilizer can be adopted; however, different levels of bagasse and mud press may still be considered since it has almost the same effect in terms of sugarcane agronomic and yield characteristics and said materials are abundantly and locally available in Piat particularly at Cagayan Sugar Milling Corporation (CARSUMCO).

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