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DIFFERENT PLANTING POSITIONS: ITS INFLUENCE ON CASSAVA YIELD (*MANIHOT ESCULENTA*)

SHARNALYN K. AMMAD
College of Agriculture, Mindanao State University, Jolo, Sulu, Philippines.
Email: sharnalyn.ammad@msusulu.edu.ph

FERNALYN H. KAIRAN
College of Agriculture, Mindanao State University, Jolo, Sulu, Philippines.
Email: fernalyn.kairan@msusulu.edu.ph

RAYHANA A. MARUJI
College of Agriculture, Mindanao State University, Jolo, Sulu, Philippines.
Email: rayhana.maruji@msusulu.edu.ph

Abstract

The study was conducted at Barangay Tubig Samin, Maimbung, Sulu, This study was conducted at Mindanao State University-Sulu demo farm (Hayudini, Hussin et al. 2023) from April 5 to November 7, 2022, and aims to determine the yield of cassava as influenced by different planting positions. The study of (MILLER and Iveaver 1976) that experiment was composed of three treatments replicated four times in a Randomized Complete Block Design (RCBD). The planting positions that served as treatments were as follows: T_1 = horizontal planting position, T2 = vertical planting position, and T3 = diagonal planting position. The gathered data were the number of tubers per plant and the weight of fresh and pressed tubers per plant. The data gathering according to the study of, (Hayudini, Hussin et al. 2022) results were interpreted accordingly. The result revealed that planting positions significantly influenced the yield of cassava. The diagonal planting position got the highest mean of 15. 75 on numbers of tubers, highest weight of fresh tuber with the mean of 3.075 kilogram, and highest weight of pressed tuber with the mean of 1.525 kilogram, followed by vertical planting position, and the lowest was revealed from cassava planted in a horizontal planting position. Based on the findings, in conditions under barangay Tubig Samin, Maimbung Sulu that have unpredictable weather conditions, the diagonal planting position is appropriate for cassava production, for it has a valuable result in terms of yield compared to other positions of planting.

Keywords: Influence; Different Planting Positions; and Cassava Yield (*Manihot esculenta)*

INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is a perennial woody shrub native to Latin America (El-Sharkawy, 2012), but primarily grown as an annual crop in the humid tropics. Traditionally, it is grown by poor and marginal farmers as a subsistence crop; however, in most growing areas in the world, it will eventually become an important commercial crop, for it has a wide range of adaptability, and because of its inherent tolerance to prolonged drought and infertile soils (El-Sharkawy, 2006), it can produce harvestable tuberous roots even in areas where other crops fail to grow (Duque and Setter, 2013; Howeler, 2001). The term cassava is derived from the word Casavior Cazabi, which in Arawak (the language of the first indigenous people who lived in the great Antilles and were in contact with Christopher Columbus) means bread (Parmar et al., 2017). It is currently the world's fourth-most important staple and carbohydrate-rich food crop (El-Sharkawy, 2012).

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Cassava production worldwide has more than doubled from 124 million tons in 1980 to 277 million tons in 2016 (FAOSTAT, 2018), which can be attributed to the ever-increasing demand for cassava crops in the food, feed, green energy, and industrial sectors. This crop is one of the largest providers of energy at 250 kcal/ha/day compared to maize (200), sweet potato (180), rice (176), sorghum (114), or wheat (110) (El-Sharkawy, 2012). The average yield of fresh tuberous root cassava varies from 1.13 to 32.68t/ha among 104 cassava-growing countries, with a global average yield of 11.80t/ha (FAOSTAT, 2018), which is much lower than the potential yield of 80–100t/ha (Byju et al., 2012). Under conducive environmental conditions, cassava can yield 80t/ha in experimental farms and up to 40t/ha of fresh tuber root in commercial fields with improved cultivars. However, productivity in seasonally dry and semi-arid environments without fertilization is much lower (El-Sharkawy, 2010). According to Byju et al. (2016), cassava production is best in sandy and sandy loam soils with a mean soil pH value of 5.5. It is generally cultivated as a rainfed crop; once it sprouts and establishes itself, it is capable of tolerating drought and can survive for up to 12–24 weeks without moisture (El-Sharkawy, 2006). In Asia, most of the cassava production is for dried cassava chips and cassava starch for use in commercial livestock feed and industrial processing (Howeler et al., 2013). Thailand, Indonesia, Vietnam, and Cambodia are the four Asian countries that produce about 26% of the world's cassava (which is 82% of Asia's production of 89.2 million tons) (FAOSTAT, 2018). In the Philippines, particularly in Sulu province, Cassava is one of the major crops planted by the farmers next to coconut (DA SAAD, 2020). Cassava is one of the favorite staple foods of tausug prior to rice; pressed cassava tubers are cooked and consumed in varied ways like siyanglag, piyuto, and biyanban that are paired with vegetables and fish or meat in tausug meals. Cassava is traditionally processed in a variety of ways, including cassava chips, crackers, pichi pichi, and paste. Aside from local consumption, cassava starch is used for industrial purposes. Cassava production deserved improvement so farmers could maximize their potential income and meet the needs of an increasing population. Sulu has fertile soil and an ideal climate that can grow a variety of crops; in fact, fertilization is not needed, especially in cassava production, for it has a wide range of adaptations. However, planting positions are known to have a great influence when it comes to the production of tuberous roots with corresponding soil and climate conditions. Different planting positions of cassava depend upon the type and condition of soil. Cuttings can be planted vertically (buds facing up with two-thirds of the cutting in the soil), horizontally (the whole cutting will be buried 3-5 cm in the soil), or inclined or diagonally (buds facing up with two-thirds of the cutting buried in the soil at an angle of about 45o). (Ekanayake et al., 1997, as cited by Amponsah et al., 2017). Furthermore, tuberous roots will bulk deep into the soil when cuttings are planted vertically, which gives more stability but is difficult to harvest. This is recommended for sandy soil and should not be practiced in arid conditions. Multiple stems and more small tuberous roots that are produced near the surface and exposed to mechanical damage and rodents are produced by cuttings planted horizontally, but in loamy and fertile soils, it has advantages that result in high yields, and it should be avoided in areas with high rainfall and heavy soil. Diagonal or inclined positions on the ridge produce roots in the same direction, which makes

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harvesting easier than other positions. They are recommended for shallow and clayey soils. Studies concluded that planting cuttings in a diagonal, inclined, or slanting manner enhanced the storage yield of cassava (Abdullahi et al., 2014; Legese et al., 2011). Hence, this research aimed to evaluate the influence of different planting positions of cassava on its yield and to determine the appropriate planting position to be used for optimum yield considering the soil and climate conditions of Sulu province, specifically in Barangay Tubig Samin, Maimbung, Sulu, where cassava is often intercropped with coconut as the main crop or in one field area, aside from banana, peanut, corn, and other vegetables.

METHODOLOGY

This study is Quantitative research which utilizes numerical form of data gathering (Aming-Hayudini, Jaddani et al. 2022)The experiment was conducted at Barangay Tubig Samin, Maimbung, Sulu, from April 5 to November 7, 2022, to evaluate the yield of cassava as influenced by different planting positions. The experiment was laid out in a Randomized Complete Block Design (RCBD) with treatments replicated four times. The different planting positions that served as treatments were as follows: T1 = horizontal planting position; T2 = vertical planting position; T_3=diagonal planting position. The land was prepared thoroughly, ploughed, and harrowed alternately two to three times to pulverize clods. An experimental area of 625 square meters was divided into 12 plots with an area of 44 square meters, and alleys of 1 meter between blocks and 0.5 meter between plots were established to separate even experimental blocks and plots. Planting materials were prepared and cut into 25 cm long cuttings; 720 cuttings were placed under shade before planting to ensure sprouting; planting was done in furrows with one cutting per hill with a distance of 75 cm between hills and 100 cm between rows with a depth of 5 cm for horizontal position; 20 cm or at least four buds were under the soil surface for vertical position; and for diagonal position, buds were facing up with two-thirds of the cutting buried in the soil at an angle of about 45°. Hand weeding, shallow cultivation, and hilling-up were done a month after planting and off-barring shortly after hilling-up to retard the growth of weeds, loosen the soil, and stimulate aeration. Repetition of the process was made as often as necessary until the canopy closed. 60 sample plants were randomly selected and marked from each plot for collecting data. Harvesting was done manually by hand, pulling the plants 7 months after planting on November 7, 2022. The stem was cut first, leaving only around 30 cm for pulling. For collecting the necessary data, sample plants were harvested and bundled separately, tagged properly, and taken into an area for counting and weighing the fresh tubers for the data on the number of tubers per plant and the average weight of fresh tubers per plant, before peeling and grating the cassava using a cassava grater, then putting it into the empty rice sack and forming a square cake to be pressed in. The pressed cassava square cake was then weighed for another data collection on the weight of the pressed yield per plant of cassava collected data were compiled accordingly for statistical analysis. The recorded data were statistically analyzed

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to find out the significant variation resulting from the experimental treatments using analysis of variance (ANOVA).

RESULT AND DISCUSSION

Average number of tuber per plant of cassava

Table 1 shows the average number of tubers per plant of cassava as influenced by different planting positions. Based on the result, treatment 3, which was planted diagonally, got the highest mean of 15. 75 followed by treatment 2, or cassava planted in a vertical position, with a mean of 10.75, and the lowest mean of 9.75 was gathered from treatment 1, which was planted in a horizontal position. Based on the analysis of variance (table 2), treatment revealed a high level of significance, while block revealed a low level of significance. It manifested that different planting positions had great influenced on number of tubers of cassava, this result was in agreement with the result reported by Legese et al. (2011), that the highest biomass yield and root yield was got from cassava planted in slant position followed by vertically planted plants and the lowest was revealed from cassava planted in a horizontal position.

Table 1: Average number of tuber per plant.

Treatment	Replication				Treatment Total	Treatment Mean
	I	II	III	IV		
Treatment I	8	9	10	12	39	9.75
Treatment II	10	12	11	10	43	10.75
Treatment III	15	14	19	15	63	15.75
Block Total	33	35	40	37		
Grand Total					145	
Grand Mean						12.08

Table 2: Analysis of Variance on average number of tuber per plants of cassava as influenced by different planting positions

Source of Variation	Degrees of Freedom	Sum of Square	Mean square	Observed F	Tabular F	
					5%	1%
Treatment	2	82.6667	41.3333	14.3077**	5.14	10.92
Block	3	8.9167	2.9722	1.0288ns	4.76	9.78
Experimental Error	6	17.333	2.8888			
Total	11	108.9167				

Treatment – highly significant

Replication – Not significant (ns)

CV= 14.06%

1.2 Average weight of fresh tuber in kilogram per plant

Table 3 presents the average weight of fresh tubers per plant of cassava as influenced by different planting positions. Treatment 3 or plants planted in a diagonal position exhibit the highest average weight of fresh tubers with a mean of 3.075 kilograms, followed by

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plants planted in a vertical position or treatment 2 with a mean of 2.225 kilograms, and the lowest was recorded in treatment 1, which was planted in a horizontal planting position. The Inferential was through correlational approach and quantitative techniques in the analysis and interpretation of data gathered (Aming-Hayudini and Kasim 2022). In the study of (Hayudini 2018) relates to Analysis of variance (table 4) revealed that treatments were significantly influenced by different planting positions, while block exhibits were not significant.

Table 3: Average weight of fresh tuber in kilogram per plant

Treatment	Replication				Treatment Total	Treatment Mean
	I	II	III	IV		
Treatment I	1.5	1.8	2.0	2.5	7.8	0.650
Treatment II	2.0	2.5	2.3	2.1	8.9	2.225
Treatment III	3.0	2.5	4.0	2.8	12.3	3.075
Block Total	6.5	6.8	8.3	7.4		
Grand Total					29	
Grand Mean						2.416

Table 4: Analysis of Variance

Source of Variation	Degrees of Freedom	Sum of Square	Mean square	Observed F	Tabular F	
					5%	1%
Treatment	2	2.75167	1.37583	6.277*	5.14	10.92
Block	3	0.63000	0.21	0.958ns	4.76	9.78
Experimental Error	6	1.315	0.2191			
Total	11	4.6966				

Treatment – significant at 5% level

Replication – Not significant (ns)

CV= 19.37%

1.3 Average weight of pressed yield in kilogram per plant.

Table 5 shows the average weight of pressed yield in kilograms per plant of cassava as influenced by different planting positions. The result shows that treatment 3, or cassava planted in a diagonal position, showed the highest mean of 1.525 kilograms, followed by treatment 2, which was planted in a vertical position with a mean of 1.075 kilograms, and the lowest was revealed in treatment 1, or plants planted in a horizontal planting position. Based on the analysis of variance (table 6), treatment or different planting positions significantly influenced the weight of the pressed yield of cassava, while blocks revealed no significant influence.

Table 5: Average weight of pressed yield in kilogram per plant

Treatment	Replication				Treatment Total	Treatment Mean
	I	II	III	IV		
Treatment I	0.7	0.9	1.0	1.2	3.8	0.99
Treatment II	1.0	1.2	1.1	1.0	4.3	1.075

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Treatment III	1.5	1.2	2.0	1.4	6.1	1.525
Block Total	3.2	3.3	4.1	3.6		
Grand Total					14.2	
Grand Mean						1.183

Table 6: Analysis of Variance

Source of Variation	Degrees of Freedom	Sum of Square	Mean square	Observed F	Tabular F	
					5%	1%
Treatment	2	0.73167	0.365835	6.4244*	5.14	10.92
Block	3	0.16333	0.054445	0.9561ns	4.76	9.78
Experimental Error	6	0.341664	0.056944			
Total	11	1.23667				

Treatment – significant at 5% level

Replication – Not significant (ns)

CV= 20.16%

CONCLUSION

The use of appropriate planting positions for cassava is an important practice to maximize the potential yield and quality of tuberous roots under favorable environmental conditions and soil types. The present study revealed that the diagonal planting position achieved the highest mean on number of tubers and weight of tubers, both fresh and pressed, followed by the vertical position, and the lowest was revealed for cassava planted in a horizontal planting position. Based on the findings, in conditions under barangay Tubig Samin, Maimbung Sulu that have unpredictable weather conditions, the diagonal planting position is appropriate for cassava production, for it has a valuable result in terms of yield compared to other positions of planting.

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