EFFECT OF STAKES PLANTING ORIENTATION ON GROWTH AND YIELD OF CASSAVA IN CLAY SOIL-SLOPING LAND

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ABSTRACT

Farmers use stem cuttings in horizontal or vertical directions to plant cassava. Both cutting and planting directions have advantages and disadvantages. On the other hand, some farmers plant cassava on sloping land with heavy soil, resulting in suboptimal crop yields. This study aims to determine the best cutting planting direction in uneven clay soil. The study was conducted at the Experimental Garden of the Faculty of Agriculture, Padjadjaran University, from October 2024 to May 2025. The study used a quantitative method with two treatments: horizontal and vertical planting directions. Observations were made on growth components (plant height, stem diameter, number of branches, and number of leaves) and yield components (number of tubers and tuber weight). The results showed that the cutting planting direction did not affect growth components or yield components, except for the number of leaves.

Keywords: Stakes; Tuber Weight; Vegetative

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INTRODUCTION

Cassava is a tuber crop widely grown in developing countries as a raw material for food products (Parmar et al., 2017). Its high productivity and resistance to various pests, diseases, and stresses make it popular among farmers (Adebayo, 2023). This plant is also used not only for its tubers but also for its leaves, which are used as vegetables (Bayata, 2019).

Cassava is usually propagated using stem cuttings (Delaquis et al., 2018). The cut stem cuttings are then planted in the field (Oketade, 2023). Farmers have two standard planting practices for cuttings: horizontal or vertical (Hauser et al., 2025). The vertical planting is believed to be more resistant to runoff and erosion, but there is no machine for planting, and there is a risk of reversed shoot growth. Horizontal orientation can be planted using a machine and will not reverse the direction of shoot growth. However, they are less resistant to rainwater runoff and erosion (Hillocks et al., 2002). With the prevalence of cassava cultivation on hills and sloping land, vertical orientation is prioritized. Horizontal planting stakes are known to produce more branches (Legese et al., 2011). However, research by Hauser et al. (2025) revealed no difference in cassava yield between upright and upright planting methods.

Heavy soils can inhibit cassava development in the soil, resulting in small cassava tubers (Stark et al., 2020). Planting cassava on sloping land has problems with erosion (Zhu & Zhu, 2014). Horizontal planting can increase the number of branches to produce more roots, but this does not necessarily increase their weight in heavy soil and sloping land. Furthermore, there is little information on the growth and yield of cassava from cuttings planted vertically or horizontally on sloping land with a high clay content. The aim of this study was to determine the effect of stake planting orientation on the growth and yield of cassava on sloping land and heavy soil.

MATERIALS AND METHODS

This research was conducted at the Experimental Field of the Faculty of Agriculture, Universitas Padjadjaran, from October 2024 to May 2025. The Oldeman agroclimatology zone at the research site was C3. The soil order at the research site was inceptisols, with a texture composition of 4% sand, 38% silt, and 58% clay. The land has an 8% slope. Climatic conditions at the research site include: temperature and humidity ranges of 23.7–23.4°C and 89–91%, respectively; average rainfall was 258.4 mm per month; and sunshine duration was 6.6 hours per day.

The materials used in this study were 8-month-old cassava stem cuttings (length 40 cm), manure, and NPK fertilizer. The tools used were a ruler, calipers, a balance, and cultivation equipment.

The research used quantitative methods. Two hundred stem cuttings were prepared. The land was prepared by thoroughly tilling the soil using a hoe, followed by fertilization with 2 tons of manure per hectare. Cuttings were planted using two treatments: vertical and horizontal planting methods, with 100 cuttings each. The plant spacing was 1 x 1 m². NPK fertilizer was applied at 1 and 3 months after planting (MAP) at a dose of 150 kg/ha each. Weeding and hilling were carried out simultaneously with fertilization. Harvesting was carried out at 7 MAP.

Observations were made on growth components (plant height, stem diameter, number of branches, and number of leaves) and yield components (number of tubers and average tuber weight). All observations were made at harvest time (7 MAP). Analysis was performed using a T-test at a 5% significance level.

RESULTS AND DISCUSSION

Results

In observing growth components, the stakes' planting orientation did not affect plant height, stem diameter, or number of branches, but affected the number of leaves (Table 1). Conversely, the cutting planting method did not affect the number of tubers or the average tuber weight (Table 2).

Table 1. Effect of Planting Orientation on Growth Component

Growth Component	Stakes Planting Orientation	
	Horizontal	Vertical
Plant Height (cm)	288.9 a	293.9 a
Stem Diameter (mm)	13.8 a	16.2 a
Number of Branches	4.7 a	3.5 a
Number of Leaves	178.5 b	138.5 a

Notes: the number followed the same letters in the row was not significantly different based on the T-test at 5% significance level.

Table 2. Effect of Planting Orientation on Yield Component

Yield Component	Stakes Planting Orientation	
	Horizontal	Vertical
Number of Tuber	6.15 a	5.85 a
Average weight of tuber (kg)	13.8 a	16.2 a

Notes: The number that followed the same letters in the row was not significantly different based on the T-test at a 5% significance level.

Discussion

The cutting planting orientation did not affect plant height, stem diameter, or number of branches. Heavy soil likely inhibits root development, both absorption and storage roots (Hillocks et al., 2002). This results in a lack of raw material for photosynthesis and energy reserves for growth (Smith et al., 2020). Ultimately, some growth components did not differ between the horizontal and vertical cutting planting orientations.

The number of leaves from horizontal cuttings was higher than from vertical cuttings. This is due to the greater number of branches produced by horizontal planting, although the difference was not significant. Branch number influences cassava leaf number (Sunith et al., 2015). The number of branches typically maintained by farmers is three, while both cutting orientations gave more than three branches. Both horizontal and vertical cuttings must be maintained through pruning to maintain a maximum of three branches. With more than three branches, increasing the number of leaves will not increase photosynthesis but will actually create a sink (Smith et al., 2020; Phoncharoen et al., 2022). These leaves are also unproductive because they block sunlight from each other (Sales et al., 2023).

There are no differences in some growth components, and the leaf number exceeding the optimal will not increase yield components (Amarullah et al., 2017). This is evidenced by the lack of differences in the number of tubers and the average weight of tubers. The absence of differences in yield components also means that crop yields are likely to be similar (Edet et al., 2015).

With no differences in almost all growth and yield components, there is no superiority between horizontal and vertical planting orientation on sloping land with compacted soil. However, we recommend planting stem cuttings upright as they are more resistant to erosion.

CONCLUSION

Whether the planting orientation is horizontal or vertical, it didn't affect growth or yield. Further research is needed to determine the differences between these planting methods in soil engineered to be light soil.

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