Yield Components as Influenced by Methods of Planting Cassava Cuttings

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ABSTRACT

A field experiment investigated, through monthly samplings, the influence of vertical and horizontal planting methods on the expression of total biological yield components of cassava.

Horizontal planting effected a greater production of roots per plant but yielded as many tubers as did vertical planting. In turn, vertical planting outyielded horizontal planting with respect to dry matter of roots, tubers, leaves, and stems.

In small farming systems where no mechanization is involved, vertical planting could be used to obtain greater yields.

The choice of cassava planting positions (vertical, horizontal, and inclined) varies according to continents, countries and within a country, according to regions (Lorenzi et al., 1981; Ezumah and Okigbo, 1981; Sinthuprama, 1981). Scientists justify adoption of a given planting position according to variety, soil characteristics, and climate. Among other reasons, Toro and Atlee (1981) found vertical planting (VP) to be generally recommended because of better and more uniform distribution of roots and consequent better anchorage that eliminates lodging. In a study published by A.C.C.T. (1981), the horizontal planting (HP) position was favored because of greater fertilizer use efficiency leading to higher yields. In large scale cassava production systems, horizontal and inclined (IP) positions are preferred because of ease of machinery usage in harvesting operations. In traditional cultivation practices, choice of a planting position is made on the grounds of old habits. To improve yields then, new but simple and efficient cultivation changes must be introduced.

In the Ivory Coast, cassava is produced mainly by small farmers in the southern part of the country where rainfall is high. HP and IP positions are common, rarely the vertical (VP). An experiment involving a high yielding variety studied, through a stepwise approach, the makeup of yield components from planting to harvest using VP and IP positions to choose the most favorable method that could be recommended to small farmers.

Materials and Methods

A field experiment from March 1981 to April 1982 use a high yielding variety CB (from People's Republic of Congo) on the ORSTOM farm where soil is sandy. *Pueraria phaseloides* had been growing on the field the previous 2 years.

Soil amendments consisted of: dolomitic stone 1,000 kg/ha, nemagon (a nematicide fumigant) 100 l/ha, and no fertilizer N P K applied. Cassava stem cuttings 25 cm long were VP and HP on the flat.

In VP, two-thirds of the total length of cuttings were placed in the soil. HP cuttings were placed flat 5 cm under the soil.

Planting density varied from 0.5x1 m to 1.5x2 m according to sampling dates and stages of growth. Such precautions were taken to minimize neighbouring root systems interpenetration and to facilitate root sampling. Vertical and horizontal lines alternated on the field. Samplings were at month intervals and consisted of digging up the whole root system in such a way that each and every root was accounted for. Ten plants/planting position were sampled each time and parameters such as total production of leaves, roots and tubers; plant height and dry matter were measured.

Results and Discussion

Roots, tuber and leaf production on the one hand, and root, tuber leaf and stem dry matter on the other hand, are discussed in this paper.

Total Root Production (Figure 1)

Root production totaled about 50 roots at 1 month after planting (MAP) in VP while HP had only produced 30 roots. However, VP reached maximum root production (55 roots) at 2 MAP while HP reached maximum (75 roots) one month later with a margin of 36% over VP. Subsequently, root number decreased steadily to stabilize at 25 for VP and 33 for HP from 10 MAP up to harvest time. However, total root loss was greater in HP (-43 roots) than in VP (-30 roots).

Tuber Production (number of bulking roots) (Figure 2)

Root bulking began 2 MAP which agrees with the reports of Cours (1951). Maximum number of bulking roots (17) was reached at 5 MAP in VP and 7 MAP in HP.

This number decreased to 14 bulking roots in both cases at harvest time. This represents 56% in VP and 42% in HP of total roots retained at harvest time. It appears that in VP position, number of tubers is maximized although total root production is less than that attained in HP.

The decrease in bulking root number from 17 to 14 roots, shows that not all the bulking roots become tubers. This fact is supported by field observations.

Leaf Production (Figure 3)

Leaf production at monthly intervals increased gradually in HP.

In VP an early large increase (from 10 to 90 leaves/month) was maintained through the 5th month. Afterwards, leaf production rate increased gradually up to harvest time. In any case, leaf production rate was maximum in the latter part of the growing season, that is, from 8 to 12 MAP for VP and from 10 to 12 MAP for HP. VP produced more leaves than did HP on both monthly and yearly basis.

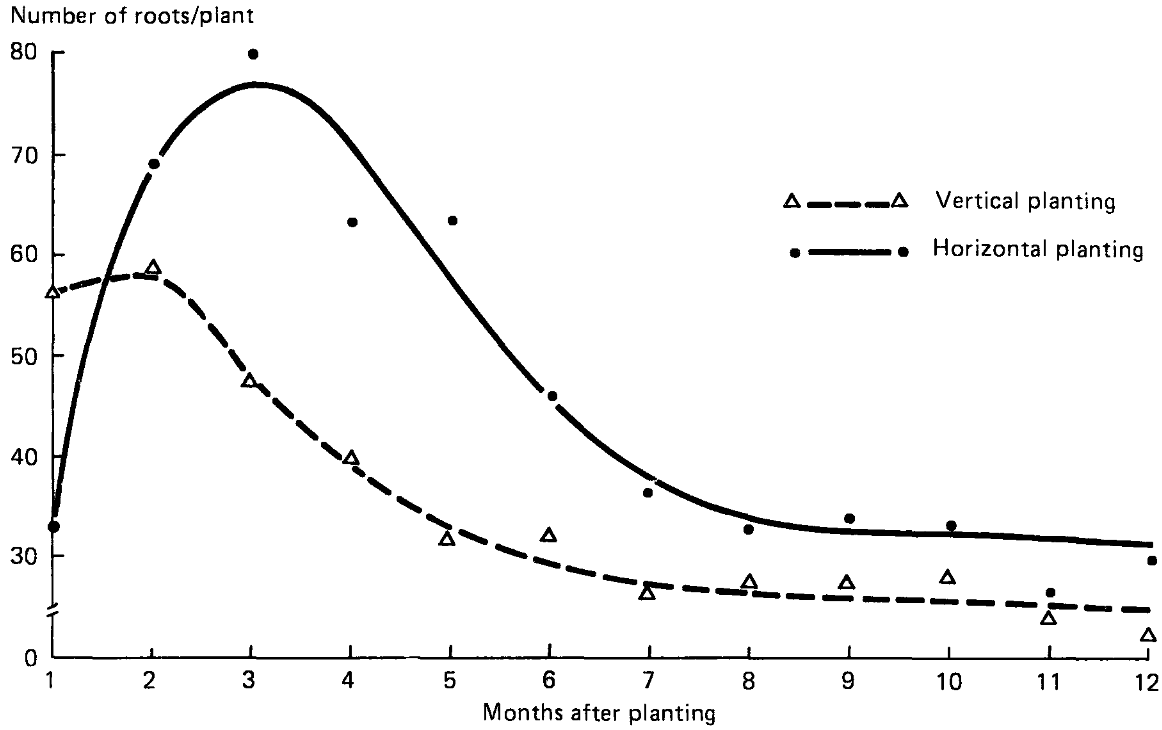

Figure 1. Influence of planting position on root production.

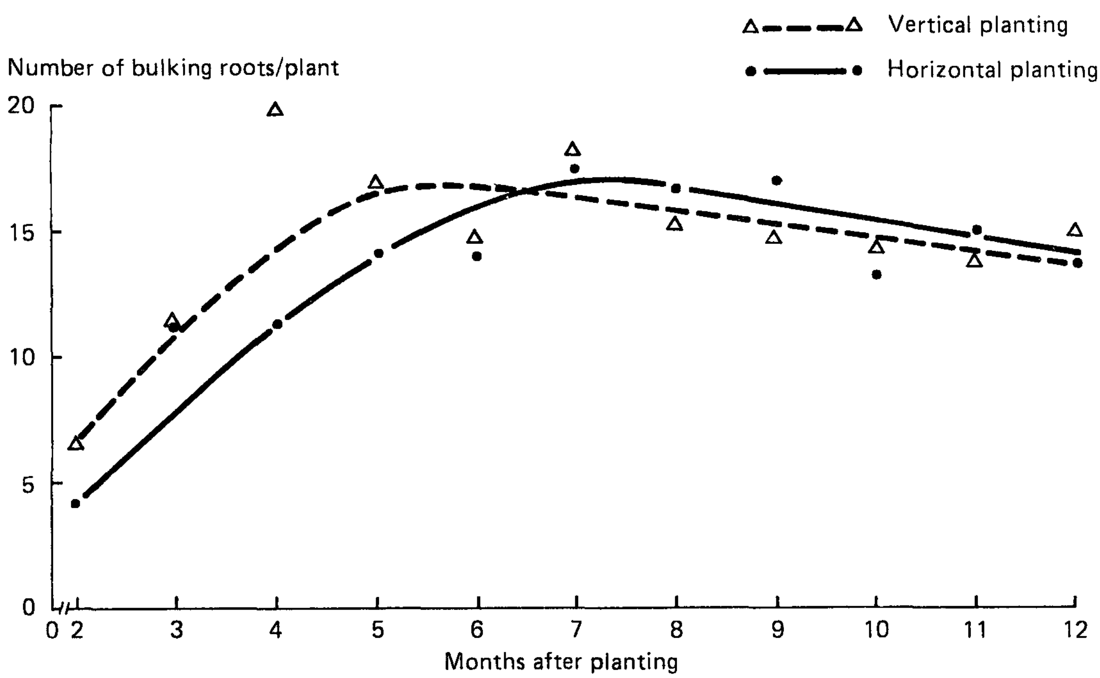

Figure 2. Influence of planting position on number of bulking roots.

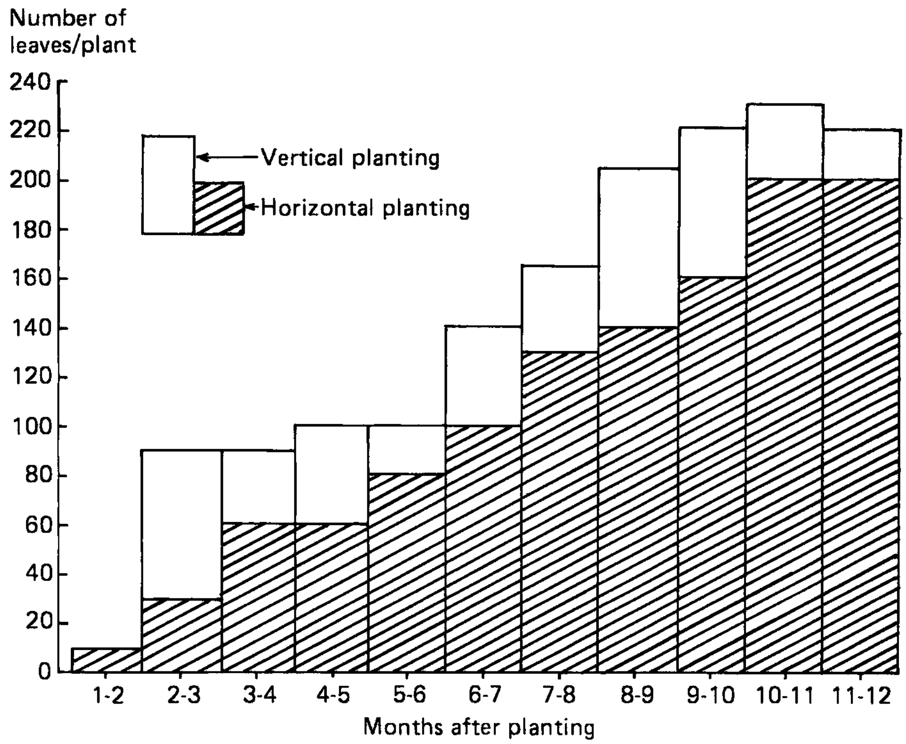

Figure 3. Influence of planting position on leaf production at monthly intervals.

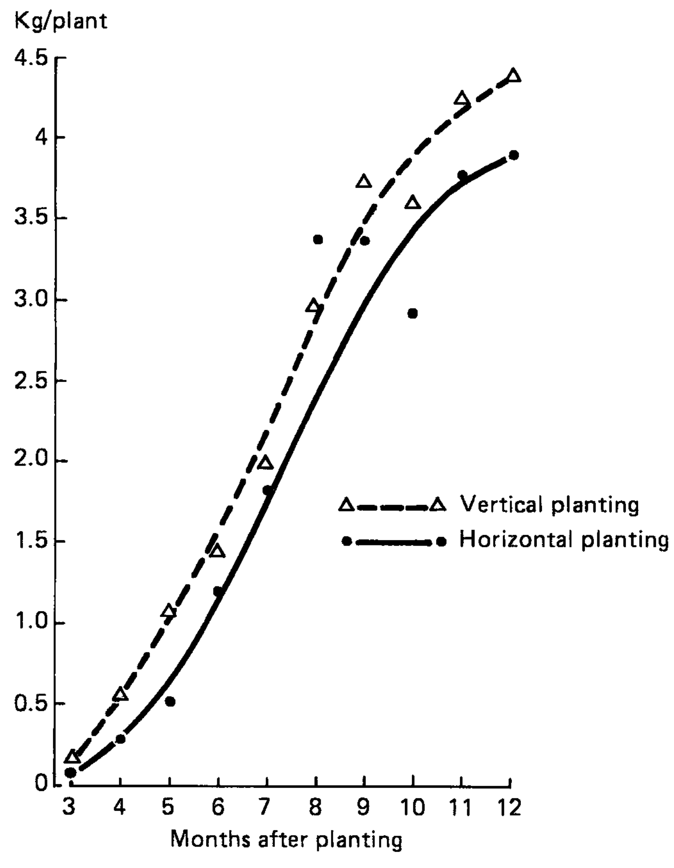

Figure 4. Influence of planting position on tuber dry weight.

Dry Matter in Tubers (Figure 4)

Dry matter accumulation in tubers followed the same pattern in both planting positions but VP accumulated more dry matter than did HP over the whole period of the growth cycle. The difference in dry matter accumulated further widened as harvest time approached. For example, at 12 MAP, the difference between VP and HP was 0.5 kg/plant, that is, 1.7 kg fresh weight/plant. Assuming a population of 3,333 plants/ha, this difference amounts to 5.7 t/ha in favor of VP.

Dry Matter in Stems (Figure 5)

Dry matter accumulation in stems was slow from 1 to 3 MAP but increased at a higher rate over the remaining months. The difference in dry matter between VP and HP increased as time went on. A difference of about 20% in favor of VP was recorded from 10 to 12 MAP.

Dry Matter in Leaves (Figure 6)

Dry matter in leaves increased sharply up to 5 MAP, reached a maximum between 5 and 7 MAP, then decreased. Throughout the growth cycle, VP effected a relatively higher amount of dry matter than did HP. At 5 MAP when dry matter accumulation was maximum, VP had a margin of 17% over HP.

The seeming discordance between dry matter accumulation pattern and that of leaf production could be attributed to maximum leaf retention, bigger leaf size and perhaps minimum migration rate of photosynthates from the leaves to the bulking roots during the earlier months (1 to 6 MAP) of plant growth. During the latter part of the growth cycle, photosynthates migrate massively from leaves to tubers (Williams, 1974).

It can be concluded from results of this experiment that VP is more advantageous than HP in terms of yields, and could be recommended to small farmers. However, these results cannot be extrapolated to other varieties.

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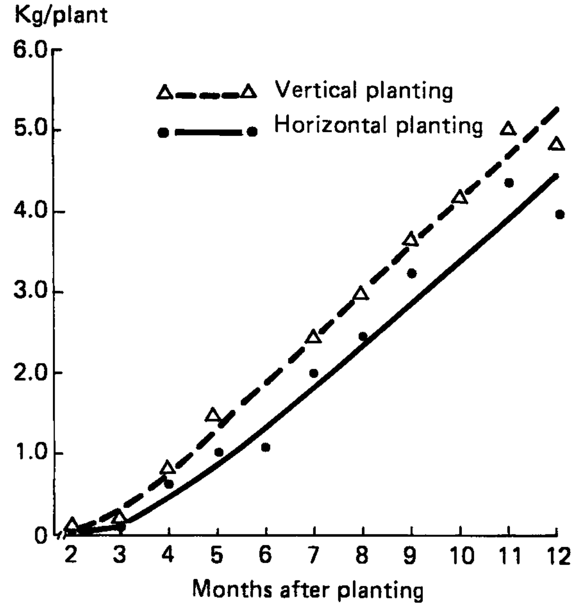

Figure 5. Influence of planting position on stem dry weight.

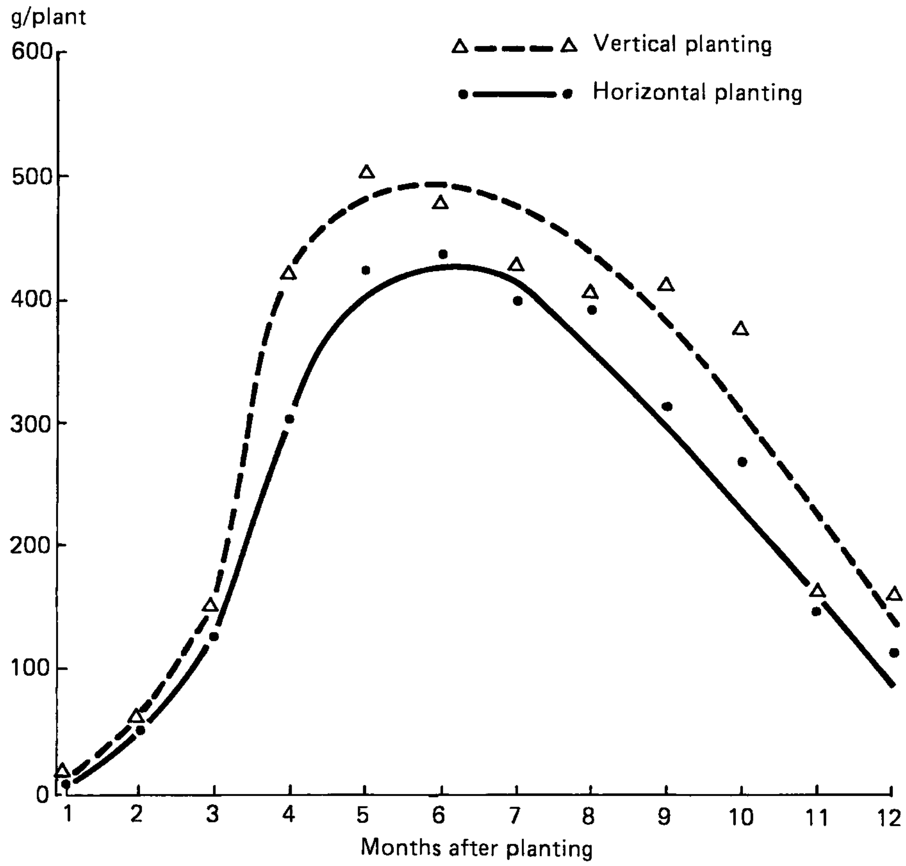

Figure 6. Influence of planting position on leaf dry weight.