6 AGRICULTURE

The effects of leaf harvesting and spacing on the yield of xanthosoma and colocasia spp

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ABSTRACT

From the sixth leaf stage onwards, three leaf harvesting treatments were imposed on Xanthosoma sagittifolium and Colocasia esculenta planted in separate experiments at 1 x 1m (S_1), 1 x 0.75m (S_2) and 1 x 0.50m (S_3). The defoliation treatments consisted of a control (no leaf harvest), alternate defoliation (harvesting of every other new leaf), and complete defoliation (harvesting of all new leaves).

In Xanthosoma, leaf harvesting resulted in significant reduction in cormel yield. The reductions from the control were 31.4% and 58.6% for alternate and complete defoliation respectively. Apart from number of cormel per plant which showed a similar trend, the other parameters, corm yield, corm size and cormel size showed no significant differences.

In Colocasia, leaf harvesting had no significant effect on corm yield. Corm size and number of suckers were significantly affected, but there was no clear trend.

Cormel yield was significantly higher at the narrowest spacing in Xanthosoma. Yield increases over S_1 were 18.2% and 59.6% for S_2 and S_3 respectively. Spacing had no significant effect on number of cormels per plant, corm yield and size of corm, but cormel size was significantly reduced at the narrowest spacing in Xanthosoma. In Colocasia, spacing had no significant effect on corm yield, but there was a 30.1% reduction at the narrowest spacing compared to the widest spacing.

Keywords: Leaf harvesting, xanthosoma, colocasia

INTRODUCTION

The leaves of cassava and young stems, petioles and laminae of sweet potato are popular foods for many African and Asian people [1] For the inhabitants of the humid forest of Ghana and indeed most Ghanaians, the tender leaves of Xanthosoma and Colocasia, especially the former, are the main, if not the only source of spinach[2] Watson[3] reported that the cocoyam leaves contained the following: 92% moisture, 1.5% protein with a range of 2.6 to 3.1, 1% fat, 12.7% carbohydrates, 3% fibre and 1.6% ash of which 142mg was Ca, 90mg, was P and 4.2mg was Fe.

The corms are also a source of carbohydrate for most people and the Akan name 'Okumkom' - meaning killer of hunger, portrays its importance to the whole country and to the Akans in particular[2] The effects of leaf harvesting on the root yield of cassava and sweet potato have been reported[1,4] However, there is little or no such information on the cocoyam. This work was therefore undertaken to fill this void.

According to Karikari,(2) the spacing adopted in planted cocoyam, in Ghana is very variable ranging from 60cm x 60cm or less to 1.8m x 1.8m. Where the plants spring up naturally when a secondary forest is cleared no spacing is adopted. It was therefore of interest to find out how different spacing affect the yield of the crop and how this was affected by leaf harvesting.

MATERIALS & METHODS

Two experiments were carried out, the first involving Colocasia esculenta and the second Xanthosoma sagittifolium. The former was planted under paddy conditions and the latter under upland conditions on a sandy loam which had been planted to cassava, the previous year. The experimental design was randomized complete block in split-plot with three replications. Spacings were

1 x 1m (S_1), 1 x 0.75m (S_2) and 1 x 0.50m (S_3), giving respective densities of 10,000; 15,000 and 20,000 plants/ha. There were four rows per plot, and data were taken on the middle two. The defoliation treatments were imposed when most of the plants had attained a minimum of six leaves. This stage was chosen to reflect what happens on farmers' fields. They were

i. control (no leaf harvesting);
ii. alternate defoliation (harvesting every other new leaf);
iii. complete defoliation (harvesting all new leaves);

The Colocasia was planted on 24th September, 1984 with suckers from a previous crop and the defoliation began three months later on 3rd January, 1985. Harvesting took place 10 months after planting on 8th July, 1985. The Xanthosoma was planted on 29th May, 1985 with pieces weighing 100-120gms. Defoliation began three months later on 29th August, 1985. After sprouting it was thinned to one plant per stand. Harvesting took place 10 months after planting on 19th March, 1986.

The Colocasia variety was the white type in which the central corm is preferred as food, and the cormels develop into suckers. The Xanthosoma was the 'red' type in which the cormels are the economic yield. Cormels in Xanthosoma therefore would correspond to suckers in Colocasia.

RESULTS AND DISCUSSION

Defoliation reduced the number of suckers in Colocasia and the number of cormels in Xanthosoma (Table 1).

Cormel yield in Xanthosoma was also significantly reduced by both alternate and complete defoliation. This reduction may be explained by the reduced cormel numbers. Igbokwe and Ogbonnaya[5] similary found that variation in the yield of cocoyam was largely accounted for by changes in cormel numbers. Number of cormels may therefore be the most plastic yield component in the cocoyam.

Corm yield did not show any significant response to defoliation in both crops but it led to a far greater reduction in Xanthosoma than in Colocasia. Compared to the control, alternate and complete defoliation reduced corm yield by 18.1% and 12.1% respectively in Colocasia., 28.4% and 38.1% respectively in Xanthosoma.

Defoliation would, therefore, appear to have a greater effect on Xanthosoma than Colocasia, and this could be explained by the difference in total leaf area and duration between the two crops. The cormels of Colocasia developed into suckers which developed leaves, and since these were not defoliated, they increased the total leaf area. Indeed, it was observed although not measured, that defoliation induced a much more rapid formation of new leaves than the control, and leaf senescene was generally not rapid. Consequently, a greater leaf area was maintained for a longer time in Colocasia growing under hydromorhic conditions. Plucknett and de la Pena[6] made similar findings.

In contrast, Xanthosoma had only one main plant and growing under upland conditions had a higher rate of leaf senescene and hence reduced leaf

TABLE 1: EFFECT OF DEFOLIATION ON YIELD AND YIELD COMPONENTS

	XANTHOSOMA					COLOCASIA		
	Cormel Yield (t/ha)	Corm Yield (t/ha)	Cormel Size (kg)	Corm Size (kg)	No. of Cormel/ plant	Corm Yield (t/ha)	Corm Size (kg)	No. of Suckers/ plant
Complete Defoliation (D_1)	1.09	1.47	0.031	0.15	3.75	1.48	0.23	10.4
Alternate Defoliation (D_2)	1.81	1.70	0.034	0.17	5.13	1.38	0.16	20.6
No. Defoliation (D_3)	2.64	2.38	0.042	0.27	7.06	1.69	0.22	17.2
LSD 5%	0.80	1.11	1.011	0.20	1.26	0.91	0.06	9.4

area duration (LAD). Igbokwe[7] also found that when cocoyams are grown under upland conditions in Nigeria, leaf area is low and lasts not more than 2-3 weeks.

Cormel and corm size were not greatly affected by defoliation although it resulted in reduced sizes in both Xanthosoma and Colocasia. Variation in corm and cormel size then would appear to be less plastic than variation in the number of corms, or cormels.

For both corm and cormel yield, there were differences in the response of the two crops to spacing. These two traits increased with increasing density in Xanthosoma. (Table 2) Cormel yield increases over 1 x 1m spacing were 35.1% and 59.6% for 1 x 0.75m and 1 x 0.50 spacings respectively. Corresponding increases for corm yield were 22.5% and 25.3%. Similarly Igbokwe[7] found 1 x 0.60m spacing to be optimum under upland conditions in Nigeria and Igbokwe et al (1984) found 1 x 0.50m spacing to be optimum. In contrast, corm yield in Colocasia was greatly reduced at the narrowest spacing. The yield reductions at the 1 x 0.50m spacing compared to the 1 x 1m and 1 x 0.75m were 30.1% and 30.9% respectively. Igbokwe et al [8] found that where soils were rich 1 x 1m spacing was optimum for cocoyams than narrower spacing. Increase in density also led to a reduction in cormel and corm size, but the extent was greater in Colocasia than in Xanthosoma.

The difference in the two crops to changes in plant density could again be explained in terms of leaf area and its duration (LAD). Leaf area and LAD were high in Colocasia. This was due to the hydromorphic conditions enabling the density to grow beyond the optimum. This would lead to mutual shading and hence an inefficient light utilization. The effect of this was the production of smaller corms. The reduction in yield at the narrowest spacing indicates that this plastic response in corm size was disproportionate and was not compensated by population number.

Number of suckers and cormels per plant were non-plastic and did not respond significantly to the spacing treatment. Thus the tendency to higher yields at higher density also derived perhaps essentially from greater overall corm numbers.

TABLE 2: EFFECT OF SPACING ON YIELD AND ITS COMPONENTS

SPACING	XANTHOSOMA					COLOCASIA		
	Cormel Yield (t/ha)	Corm Yield (t/ha)	Cormel Size (kg)	Corm Size (kg)	No. of Cormel/ plant	Corm Yield (t/ha)	Corm Size (kg)	No. of Suckers/ plant
1 x 1m	1.47	1.60	0.04	0.23	5.11	1.68	0.27	13.0
1 x 0.75m	1.74	1.95	0.037	0.23	5.50	1.69	0.24	19.1
1 x 0.50m	2.35	2.00	0.029	0.13	5.33	1.17	0.10	16.1
LSD 5%	0.46	1.14	0.01	0.16	2.0	0.76	0.11	9.80

CONCLUSION

The results of these experiments, compared to similar results in the literature lead to the following conclusions, though these have to be confirmed through further experimentation.

- That the optimum for yield for paddy Colocasia lies between 1 x 1m and 1 x 0.75m
- That for Xanthosoma was about 1 x 0.5m
- That defoliation greatly reduced yields in Xanthosoma, but was less in Colocasia
- That alternate defoliation was bad as complete defoliation regarding reduction in yield.
- Where irrigation facilities are available, or where a long dry season does not exist, some amount of defoliation may not have a great detrimental effect on corm and cormel yield.

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