Harvest frequency exerted a significant effect on the production of dry roots. The yield of frequency 3 (foliage and root harvest at 12 months) was the highest (5.7 t/ha), and was significantly different from frequency 1 yield (3.1 t/ha). No difference was observed between frequency 2 and 3 yields, indicating that cutting the foliage at 8 months does not affect the dry matter production of cassava roots.

Rainy Season Harvest (12 Month Cycle)

Fresh foliage production was 86.4, 68.4, and 59.1 t/ha for densities 1, 2, and 3, respectively. Density 1 showed a highly significant difference from density 3, and a significant difference from density 2.

Density 1 dry foliage production was highly significantly greater than densities 2 and 3. There were no statistical differences between densities 2 and 3. Frequency 3 had the highest yield (foliage harvest at 9 and 12 months) (17.7 t/ha). This was significantly greater than frequency 1 (3, 6, 9, and 12 months) (14.5 t/ha).

In fresh foliage production, density 1 (31 250 plants/ha) yielded significantly more than density 2 (15 525 plants/ha) and density 3 (10 412 plants/ha). The highest yields of fresh foliage were 154.9, 165.7, and 147.7 t/ha for frequencies 1, 2, and 3 at density 1.

Density 1 (31.9 t/ha of dry foliage) yielded significantly more than densities 2 (24.2 t/ha) and 3 (22.0 t/ha).

The protein contents of the cassava foliage determined from the first harvest of the dry season were superior to those of the third harvest, because there was a greater proportion of herbaceous material (leaves and sprigs) at 4 months than at 12 months. The protein production values of cassava foliage were highest for density 1 and for frequency 1, with values of 2.2 and 2.4 t/ha of protein, respectively.

Conclusions

By comparing the foliage production of dry and rainy season planting over a 12 month period, it is evident that for both fresh and dry matter production, planting the crop in the rainy season is better.

During the dry season, cutting frequency but not plant density exerted a significant effect on fresh foliage production. In the wet season, both density and cutting frequency influenced foliage yield.

Root production was seriously affected by cutting the foliage at 4 months. However, cutting at 8 months only reduced yield slightly because the roots had already formed and accumulated reserve material.

Excellent dry foliage and protein production can be obtained by successive cuttings at 3, 6, 9, 12, 14, and 17 months.

It would seem advantageous for foliage production in the ecological conditions found in Maracay to plant in the rainy season, with densities of between 31 250 and 15 625 plants/ha. Harvests should then be done every 75–90 days, up to 17–20 months. Production should be for foliage only, not roots and foliage. It will be necessary to develop a system to mechanically prune the foliage and thus reduce the manual labour factor.

The Effect of Various Levels of Cassava Leaf Meal in Broiler Chicken Rations

J. J. Montilla, R. Vargas, and A. Montaldo[1]

Cassava leaf meal was used as a protein source in the rations of 1-day-old Vantress × White Rock chicks. When rations were administered in meal form, body weight gain and dietary efficiency were depressed at all levels of foliage addition up to the sixth week. This depression was noticeable during the last 4 weeks only at the top level of substitution. Pelleting greatly improved the adverse effects that appeared when the feed was given in meal form.

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Table 1. Body weight and dietary efficiency gains in experiment 1.

Treatment	0–6 weeks		0–8 weeks		0–10 weeks	
	BW	DE	BW	DE	BW	DE
0%	1049Aa	2.3Aa	1495Aa	2.6	1920As	2.8Aa
10%	940Bb	2.6Bb	1395Ba	2.8	1845Aab	3.0Aab
20%	801Cc	2.8Cb	1262Cb	3.0	1699Bbc	3.1Bb

NOTE: Different lower case letters after values in a column indicate significant differences ($p = 0.01$); different capital letters after values in a column indicate significant differences ($p = 0.05$).

Cassava foliage has a high protein content that may be as high as 22% when it is cut at 2-month intervals. When cassava is planted for the sole purpose of harvesting its leaves, yields of up to 150 t/ha per year may be obtained. Therefore, cassava should be considered as an alternative when trying to solve the problem of protein deficiency in rations for domestic animals in the tropics.

According to Eggum (1970), the protein in cassava leaf matter is deficient only in methionine and its biological value, as determined in rats, reaches from 49 to 80% when supplemented with this amino acid. At the same time, nitrogen is increased from 2.04 to 3.02%.

Ross and Enriquez (1969) fed poultry with rations containing meal from the leaves and stalks of cassava at levels of 3–20%. They found depression in growth and dietary efficiency. This situation was remedied by supplementing with 0.2% methionine and 3% corn oil. They concluded that methionine was the first limiting factor, and that energy was the second, in chicken rations containing cassava leaf meal.

The objective of this study was to further investigate the possibility of using cassava leaf meal in broiler rations.

Material and Methods

Two 10-week tests were carried out, in a completely randomized system, using a total of 480 Vantress × White Rock 1-day-old chicks. The test unit in both experiments was 10 broilers, with four groups assigned to each treatment. The birds were placed in four-tiered, metal batteries that were electrically heated. A daily record of feed consumption was kept, and the chicks were vaccinated against fowl pox, avian diphtheria, and Newcastle disease. The rations administered were prepared starting from a base ration of corn, sesame, cotton, soybean, meat, and bone and fish meal, balanced for all nutrients.

The cassava leaves contained: 93.5% dry matter; 21.4% crude protein; 4.8% ether extract; 27.1% crude fibre; 36.9% nitrogen-free extract; and 9.9% ash. The meal was prepared by chipping the foliage in a stationary chipper, drying it in the sun for about 24 h, and then grinding it in a hammer mill.

The cassava leaf meal was added to the basic ration at levels of 10, 20, and 30%, substituting the oil-seed (sesame and cotton) and the cornflour by 75 and 25%, respectively, for each substitution level. The rations with cassava leaf meal were supplemented with 0.15% methionine for every 10% of foliage added.

In the first experiment, feed was administered in the form of meal and, in the second, rations in the form of meal and pellets were compared. Water and feed were administered freely and a daily record of consumption kept. The broilers were weighed at the start of the experiments and then every 2 weeks. The data were subjected to variance analysis and to Duncan's multiple comparison tests.

Results and Discussions

Table 1 summarizes the data for experiment 1 for body weight gain and dietary efficiency. There was a highly significant linear depression ($p = 0.01$) for body weight gain at the second week. This situation continued up to the sixth week, when the broilers fed on the rations with 20 and 30% cassava leaf meal reached only 83.5% of the gain reached on the basic ration. Body weight gains reached during the seventh, eighth, ninth, and tenth weeks were very similar for all treatments, indicating that the broilers made better use of the rations with the cassava leaf meal as they grew older.

Table 2. Body weight and dietary efficiency gains in experiment 2.

	0–6 weeks		0–8 weeks		0–10 weeks	
Treatment	BW	DE	BW	DE	BW	DE
F-0%	1110a	2.1a	1469bc	2.1a	1987c	2.5a
F-0%-P	1093a	2.2abc	1615a	2.5bc	2123a	2.8bc
F-10%	1002ab	2.3abc	1463c	2.6cd	1962c	2.8c
F-10%-P	1026ab	2.4abc	1612a	2.5bc	2089b	2.7bc
F-20%	886cd	2.6c	1311e	2.9ef	1774e	3.2def
F-20%-P	995ab	2.5abc	1511b	2.8de	1972c	3.1cde
F-30%	759c	3.2d	1190f	3.3g	1720f	3.4f
F-30%-P	932bd	2.6bc	1387d	3.0f	1870d	3.3f

NOTE: F = foliage; 0, 10, 20, and 30% = levels of addition; P = pelletized. Different lower case letters after values in a column indicate significant differences ($p = 0.01$).

A similar situation existed with regard to dietary efficiency. This was depressed at each level of foliage addition up to the sixth week. At the eighth week, noticeable differences existed only between the ration with 30% foliage and the other three. The fact that the relatively large differences that are shown in dietary efficiency during the second and tenth weeks do not show significance, is due to the large losses caused by food spillage that results in a high degree of individual differences among groups. This food spillage was due to the low consistency given to the meal by the foliage.

It is evident that at any of the levels of cassava leaf meal studied, with meal type rations, at least 9 weeks are required for broilers to reach marketable body weight. At the tenth week, the efficiency of food conversion was reduced by 5.7, 12.1, and 23.2% when foliage was added at levels of 10, 20, and 30%.

Table 2 summarizes the information obtained from experiment 2. It is evident that the meal preparation in pellet form improved body weight gains and dietary efficiency, up to the eighth week. This effect was not shown for the ninth and tenth weeks, during which time, no appreciable differences were noted, either for the form of the feed or between the levels of cassava foliage used.

The best body weight and food conversion gains were reached with the basic ration, but the differences shown between this and the pelleted rations, with 10 and 20% foliage, although significant in some cases, were small and comparable to those recorded in commercial enterprises.

On the other hand, the reduction in ration costs largely compensates for the reduction in dietary efficiency. With the ration of 30% foliage in pellet form, weight gain was comparable with commercial levels, but the dietary efficiency loss was large. The economic effect must be evaluated before deciding whether to use foliage at this level. This would necessitate obtaining cassava foliage production cost data.

Conclusions

This preliminary work suggests that it is possible to add cassava leaf meal, at relatively high levels, to the rations of broiler chickens in pellet form. Studies should continue in an attempt to clarify the possibility of using this material.

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