Effect of Some Intercrops on Taro

Author: P. Sivan, Research Division, Ministry of Agriculture and Fisheries, Fiji.

SUMMARY

As the taro plant develops slowly during its early growth, it has the potential for intercropping during this period. The effects of six intercrops, longbean, cowpea, peanut, corn, okra and sweet potato on taro were studied.

All intercrops reduced taro yield and the extent of reduction varied with crops. Highest yield reduction, nearly 40%, was when okra was the intercrop. Corn, longbean, and cowpea reduced taro yield by about 16%, 20%, and 23%, respectively. The taro/longbean crop mixture gave the highest gross return, 50% above the non-intercropped taro treatment. Corn, cowpea and okra also increased the gross returns but less.

## Introduction

Although the edible aroids (family Araceae) are grown throughout the tropics and sub-tropics, they are of greatest importance in the Pacific region. Five species of aroids (Colocasia, Xanthosoma, Cyrstosperma, Alocasia and Amorphophallus) are grown for food in the region but taro (Colocasia esculenta var. esculenta) is by far the most important and a main staple food crop.

Traditionally taro in Fiji and elsewhere in the Pacific is grown under upland conditions in high rainfall areas in a mixed cropping system with long, medium, and short term crops. In Fiji long term crops generally are coconuts, cocoa and other tree crops, the medium term crops are banana and yagona (Piper methysticum), and the short term crops are other root crops and vegetables. A recent increasing tendency is to grow taro as a monocrop. The lastest two censuses of agriculture estimate that in Fiji in 1968 only about 25% of taro was grown as monocrop (Casley, 1969) but in 1978 over 50% was grown as monocrop (Rothfield and Kumar, 1980). Taro monocropping has assumed importance especially in near urban centres, where taro is grown largely as a commercial crop.

Onwueme (1981) has discussed merits of two situations in which taro is mixed with other crops. In one taro occupies lower levels of the canopy (when grown with taller crops) and in the other taro occupies the upper canopy layer (when low growing crops are planted between stands of taro). In traditional mixed cropping systems the former situation predominates and taro yields are generally lower due to shade conditions. Even in related Xanthosoma species, believed to be more shade tolerant than taro and often grown in shady conditions, it has been found that increasing light intensity increases yield (Rashid and Daunicht, 1979). The

possibility to intercrop taro with less effect on its yield appear better with the second situation described above.

The taro leaf area develops slowly from planting and peaks at about 5 to 6 months and then declines (Plucknett and de la Pena, 1971; Ezumah and Plucknett, 1973; Sivan, 1979). Leaf area development of three selected varieties under Fiji conditions shown in Table 1 indicate that for only a short period at mid-crop the leaf area is at about the optimum (LAI = 3) and for considerable periods early and late in growth of the crop when the leaf area is low it could be profitably intercropped.

Table 1. Leaf area duration (weeks) of main plant and suckers of three taro varieties in Fiji.

| Variety | Leaf Area Index | | | | | | |
|---|---|---|---|---|---|---|---|
| | <1 | >1<2 | >2<3 | >3 | <3>2 | <2>1 | <1 |
| Hawaii | 9 | 4 | 2 | 13 | 11 | 9 | 0 |
| Qawe ni Urau | 9 | 4 | 2 | 8 | 3 | 12 | 10 |
| Tausala ni Samoa | 9 | 7 | 4 | 0 | 6 | 12 | 10 |

Recent studies show that taro production as a commercial monocrop gives a low gross income of between F$1500 to F$2700 (Chandra and Sivan, 1981; Sivan, 1981). To investigate if income could be improved by intercropping early with short duration crops and to study effect of intercrops on taro, the trial discussed below was undertaken.

## Experiment

The trial was on alluvial soil at Koronivia Research Station. Three leguminous crops, cowpea, longbean and peanut, and three other crops, corn, okra and sweet potato, all having good market potential in the area were selected for the study. Both taro and intercrops were planted the same day, taro 60 cm apart in the furrows 1 m apart (density 16,666 plants/ha) and intercrops were planted on the ridges formed between the furrows. Populations densities of cowpea, longbean, peanut, corn and okra were 33,332 plant/ha and sweet potato was same as that for taro. Including a non-intercropped taro treatment, seven treatments were replicated three times. From a gross plot area of 7.2x6 m, an inner area 6x4 m was used for taking yield and other records. The taro crop was fertilized with 100 kg N, 25 kg P and 100 kg K and the intercrops at half this rate.

Cowpea, longbean, corn and okra were harvested as green vegetables whereas the remaining two intercrops were harvested when fully mature. At 18 weeks after planting, when all intercrops were harvested, the leaf area indices of taro in various treatments were determined to measure the effect of the intercrops at this stage. Then taro plants were ridged-up and the crop was harvested 11 months after planting.

## Results and Discussion

Intercrops duration and leaf area indices of taro are in Table 2 while yields of taro and intercrops plus their gross value at the farm gate are in Table 3. To estimate gross value, current prices were used (also in the table).

Table 2. Crop duration of intercrops and the leaf area indices (LAI) of taro at 18 weeks in various treatments.

| Treatment | Intercrop duration (weeks) | LAI of Taro* |
|---|---|---|
| Taro (non-intercropped) | - | 1.33a |
| Taro/Peanut | 18 | 1.28a |
| Taro/Corn | 12 | 1.12a |
| Taro/Longbean | 11 | 1.08a |
| Taro/Cowpea | 11 | 1.02ab |
| Taro/Sweet potato | 18 | 0.52b |
| Taro/Okra | 18 | 0.51b |
| S.E. ± | - | 0.16 |

*Treatments with different letters in the column are significantly different (p = 0.05).

Table 3. Yield and gross value of taro and intercrops.

| | Yield (t/h) | | Gross Value (SF/ha)† | | |
|---|---|---|---|---|---|
| Treatment | Taro | Intercrop | Taro | Intercrop | Total |
| Taro | 18.2a* | - | 4,550 | - | 4,550 |
| Taro/Peanut | 15.8ab | 0.29 | 3,950 | 290 | 4,240 |
| Taro/Corn | 15.2b | 7.32 | 3,800 | 1,464 | 5,264 |
| Taro/Longbean | 14.5bc | 6.40 | 3,625 | 3,200 | 6,825 |
| Taro/Cowpea | 14.0bc | 3.26 | 3,500 | 1,630 | 5,130 |
| Taro/Sweet potato | 12.4cd | 1.54 | 3,100 | 385 | 3,485 |
| Taro/Okra | 11.1d | 7.25 | 2,775 | 2,175 | 4,950 |
| S.E. ± | 0.71 | - | - | - | - |

*Treatments with different letters in the column are significantly different (p = 0.05).

†Gross values of crops were estimated at current prices: taro and sweet potato 25c/kg; corn 20c/kg; okra 30c/kg; cowpea and longbean 50c/kg and peanut $1.00/kg.

With the exception of peanut, all intercrops significantly reduced taro yield. The peanut intercrop was severely affected by diseases resulting in low plant population and yield. Due to this the affect on taro yield may have been

lessened. When this treatment is disregarded, other treatments show that the extent of reduction in taro yield was dependent upon the length of the period of competition between the taro and the intercrops. Corn, longbean and cowpea which were completely harvested by 12 weeks had less effect on taro yield than later sweet potato and okra harvested at 18 weeks. Leaf area indices of taro at 18 weeks also clearly support this. Okra and sweet potato drastically reduced the leaf area of taro while corn, longbean and cowpea had less and non-significant effect on the leaf area of taro.

Relatively small reduction of taro yield in the taro/corn mixture indicate that it is possible to intercrop taro with taller crops provided the intercrop is harvested by about 12 weeks. However, if taller crop of long duration (e.g. okra) is intercropped, then yield taro is severely reduced.

In taro grown under upland conditions, three phases in growth are recognized (Sivan, 1979). In the first phase, which lasts for 8 weeks, the plant develops slowly. In the second phase the plant accumulates dry matter rapidly reaching a peak at 22 to 24 weeks. During this phase there is also very rapid increase in the leaf area. In the third phase, from about 24 weeks onward, top growth and leaf area both decline but rapid corm growth continues until harvest at about 40 to 48 weeks. Because the taro plant develops slowly during the first 8 weeks, intercrops of short crop duration (less than 12 weeks) appear most suitable. These crops have much less effect and the taro plant recovers during the rapid growth phase. Long duration crops extend into and compete with taro during the rapid development phase and the plants are unable to recover sufficiently before rapid corm development takes over, hence the low yield.

When the total values of the crop mixtures are considered the taro/longbean combination gave the best return. It increased the gross returns by 50% compared to taro alone. The taro/corn, taro/cowpea and taro/okra combinations also increased returns but the increases were much smaller at about 18%, 15% and 11%, respectively. Okra as an intercrop that affects taro yield drastically may not be of interest to farmers who grow taro as the main crop.

The study shows that where taro is produced commercially as a monocrop on small size farms, gross returns can be considerably increased by intercropping with short duration crops.

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