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# PERFORMANCE OF COWPEA CULTIVARS AS INTERCROPS AND THEIR EFFECT ON EARLY SUGARCANE TILLERING ON A CAYMANAS SOIL

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## ABSTRACT

Five cultivars of cowpea (Vigna unguiculata (L). Walp.) were compared as intercrops of sugarcane during the 1981/82 spring planting season. Differences in flowering rate of cultivars between season were noted. At populations of 57,000 plants $ha^{-1}$, seed yields ranged from 162 Kg/ha (VITA 3) to 448 Kg/ha (Laura B).

Shelling percentages and the number of pods/plant, significantly affected yields of all cultivars.

Number of tillers in the Laura B plots at 81 days were significantly higher than other cultivars. However, the heights of tillers in both Laura B and TVX 1850-01E plots were demonstrably shorter.

Although nitrogen levels of the soil, following intercropping were appreciably increased, no significant differences in other soil chemical properties were observed.

## INTRODUCTION

Sugarcane (Saccharum officinarum L.), the major crop of the Caribbean, has a slow growth rate in the initial stages of establishment. During this period, a quick-growing short duration legume may be fitted in without adversely affecting the sugarcane crop. Cowpea (Vigna unguiculata L. Walp) is a commonly cultivated intercrop. The importance of this food legume in the Caribbean has been recognised by many authors (FERGUSON, T. 1975, WOOLLEY, J. 1981).

Although the intercropping of sugarcane with cowpea encompasses the possibility of increasing legume production, a major concern for the sugarcane producer,

is the degree to which intercropping affects sugarcane tillering and ultimately sugarcane quality and yields.

To date, the effects of intercrop on sugarcane has been variable. RAZZAQUE et al (1978) reported supression of sugarcane tiller production as a result of the effects of chickpea (Cicer arietinum L.) PRASADARAO et al (1969) observed reductions in final stalk populations of sugarcane at harvest due to the effects of the groundnut (Arachis hypogea) intercrop. THOMAS, A. (1980) reported the inhibition of early tillering of cane when intercropped with cowpea, snapbeans (Phaseolus vulgaris) and cucumber (Cucumis sativa),while the inhibitory effect of peanuts (A. hypogea) and red kidney beans (Phaseolus vulgaris) on tillering was observed at a later stage.

In India, intercropping with wheat (Triticum asetivum L.) significantly reduced tiller numbers (SINGH, P.P. and SINGH, A. 1974). CHENG, D. S. (1979) found that altering the planting method for intercropping cane with corn (Zea mays) enhanced sugarcane tillering and yields.

This paper, is a preliminary report of sugarcane-cowpea intercropping studies in Jamaica. The paper presents observations on the relative performances of five cowpea cultivars under intercropping conditions; it examines the relative effects of intercrop establishment on early sugarcane tillering and it reports on observed differences in soil chemical properties following intercropping.

## MATERIALS AND METHODS

The experiment was conducted on Farm No. 2 of the Caymanas Estate Cowpark, St. Catherine during the 1981/82 spring planting season. The soil type was Caymanas Loam. VERNON and JONES (1958) describe this soil as well drained, deep alluvium of high fertility with a distinctly alkaline reaction .

Soil properties prior to planting were pH 7.7, organic matter 1.7%, P: 400 (Troug) K: 322 ppm, N: 0.08%.

Sugarcane (Cv.UCW 5465) was planted on February 19th in furrows 1.7 m apart. Four cultivars of cowpea obtained from the International Institute of Tropical Agriculture (IITA) TVX 2912-011D, VITA 3, TVX 1850-01E and TVX 3381-02F were planted as intercrops. A local cowpea Cv. Laura B was used for comparison as an intercrop. Intercrop cultivars were selected on the basis of growth habit,

seed colour and yield as observed from their performances in pure stand during the previous planting season.

The five treatments were replicated four times in a 5 x 4 row and column design (LAUCKNER, F.B. 1980). Plot size was 5 m x 10 m = 50 $m^2$.

The intercrops were planted on February 25th in rows approximately 25 cm from the sugarcane row. There were two rows on each bank, one on either side of the cane row. Intercrops were planted 20 cm within the row at an intended plant population of 57,000 plants $ha^{-1}$.

No fertilizer was applied for the intercrop, but other cultural practices appropriate to the cane and intercrops were conducted. Surface irrigation was done according to the standard estate practice for sugarcane.

Soil samples were collected prior to and following intercropping. Data on days to fifty percent flowering (D.F.F.),yield and yield components, canopy width and height were collected for the intercrop. For sugarcane, the rate of tillering, height and diameter of plants were measured.

## RESULTS AND DISCUSSION

Table 1, Fig. 1 indicate the relative time (in days) of each intercropped cowpea cultivar to attain 50% flowering. Cultivars, Laura B and TVX 1850-01E were earliest, each having days to fifty percent flowering (D.F.F.) of 45 and 47 respectively. Up to 64 days following planting, no other cultivar had reached 50% flowering. Heavy rainfall resulted in defloration of many of the cultivars at 64 days, hence no conclusive assertions can be made concerning D.F.F. of VITA 3, TVX 3381-02F and TVX 2912-011D. However, from observations made up to that time, TVX 2912-011D was the latest flowering of all cultivars tested.

Table 1. No. of days to fifty percent flowering of five intercropped cultivars of cowpea

| CULTIVAR INTERCROPPED WITH SUGARCANE | DAYS TO 50 PERCENT FLOWERING | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 42 | 44 | 47 | 50 | 54 | 56 | 62 | 64 |
| TVX 2912-011D | 0.0 | 0.1 | 1.4 | 3.7 | 10.8 | 14.0 | 23.5 | 28.3 |
| VITA 3 | 2.0 | 4.0 | 16.7 | 22.1 | 25.6 | 27.4 | 33.5 | 41.9 |
| TVX 1850-01E | 35.8 | 45.8 | 50 | - | - | - | - | - |
| TVX 3381-02F | 0.0 | 0.1 | 0.5 | 2.5 | 6.8 | 8.8 | 26.7 | 37.6 |
| Laura B | 42.4 | 49.5 | 50 | - | - | - | - | - |

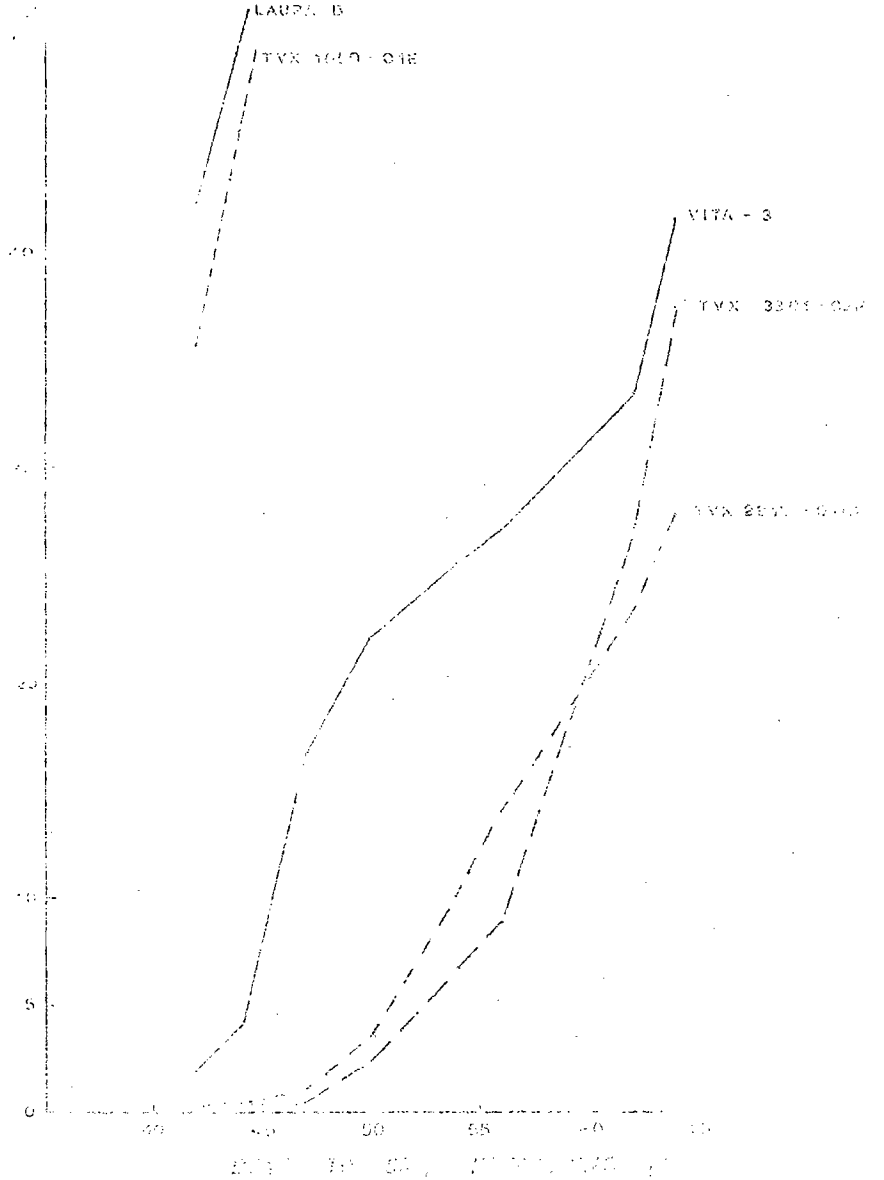
Mean percentage of flowering plants

The data pertaining to D.F.F. differs from that obtained for cultivars when grown in a pure stand during the previous cropping season at a similar location. (THOMAS, A. 1981). Laura B was the only cultivar for which D.F.F. remained unchanged over the two consecutive seasons. D.F.F. for the cultivars, TVX 1850-01E, TVX 3381-02F, TVX 2912-011D and VITA 3, were 50, 53 and 58 respectively.

A possible explanation for the variation in flowering of some cultivars over the two seasons, is that the imported cultivars are more vulnerable to slight environmental changes. These changes may result in either a decrease or increase in flowering rates to produce the observed variations. The cultivar, Laura B, which was bred under local conditions, remains stable and is therefore less likely to show wide fluctuation in behaviour under local environmental conditions. Additionally, increased moisture due to uneven surface irrigation may have resulted in prolonging the vegetative phases of some cultivars.

There was uniformity of stand counts in all plots, hence differences in yield may be attributed to yield components of the cultivars.

Fig. 3



Dry pod yield for the intercropped cultivars ranged from 343 Kg/ha (VITA 3) to 700 Kg/ha (TVX 3381-02F). Relatively high shelling percentages for the cultivars Laura B, TVX 1850-01E and TVX 3381-02F resulted in the production of significantly higher seed yields ($P < 0.05$) than the cultivars TVX 2912-011D and VITA 3.

Although significant differences between cultivars were registered for weight of 100 seeds and number of seeds/pod, these yield components did not influence total seed yield (Table 2). VITA 3 produced significantly less pods per plant ($P \leq 0.05$) than all cultivars.

Table 2. Performance of cowpea cultivars intercropped with sugarcane. Yield and yield components (at 7% moisture)

| CULTIVAR | TOTAL POD YIELD (Kg/ha) | SEED YIELD (Kg/ha) | PODS/ PLANT | SEEDS/ POD | 100/ SEED (wt/gms) | SHELLING PERCENTAGE |
|---|---|---|---|---|---|---|
| TVX 2912-011D | 443.36 bc[1] | 205.32 b | 14.52 b | 11.94ab | 16.73 b | 47.45 cd |
| VITA 3 | 342.82 c | 162.37 b | 3.33 c | 11.07 b | 18.16a | 43.89 d |
| TVX 1850-01E | 695.22a | 422.41a | 10.70 b | 12.84a | 12.03 d | 60.86ab |
| TVX 3381-02F | 700.46a | 386.74a | 10.44 b | 10.93 b | 16.03 b | 54.54 bc |
| Laura B | 639.39ab | 448.80a | 18.86a | 9.46 c | 13.69 c | 68.63a |
| SE (±) | 139.5 | 86.3 | 2.42 | 0.82 | 0.80 | 5.40 |
| CV (%) | 24.73 | 26.55 | 20.94 | 7.29 | 5.24 | 9.81 |

[1]Means with a common letter are not significantly different at 5% level using Duncan's Multiple Range Test.

The significantly higher canopy widths recorded for VITA 3 and TVX-1850-01E (Table 4) emphasises the profused vegetative growth of these cultivars. Pod width and length (Table 4) had no significant effect on seed yield.

Differences among the number of sugarcane tillers/20 m length at the stages 23, 42 and 116 days after planting intercrops, were not significant (See Table 3). At 81 days, significant differences among intercropped cultivars were evident. Sugarcane tillers produced in plots intercropped with the cultivar Laura B were significantly greater ($P < 0.05$) than all other treatments. Significant reductions of tillers by VITA 3 ($P < 0.05$) were also observed. Tillering was suppressed least by Laura B. Tiller suppression as a percentage of the number of tillers produced under intercropping conditions with Laura B were 36.5%, 24.6%, 21.4% and 10% for the cultivars VITA 3, TVX 2912-011D, TVX 3381-02F and TVX 1850-01E respectively.

Table 3. The effect of intercropping on the emergence of sugarcane tillers at 23,42, 81 and 116 days following intercropping

| INTERCROP CULTIVARS | MEAN NUMBER OF SUGARCANE TILLERS/20 cm LENGTH DAYS FOLLOWING INTERCROPPING | | | |
|---|---|---|---|---|
| | 23 | 42 | 81 | 116 |
| TVX 2912-011D | 60.28 | 79.95 | 97.13 c | 137.90 |
| VITA 3 | 64.55 | 76.48 | 81.80 d | 94.83 |
| TVX 1850-01E | 61.22 | 66.15 | 115.93 b | 131.57 |
| TVX 3381-02F | 63.68 | 77.68 | 101.27 c | 121.77 |
| Laura B | 74.02 | 76.48 | 128.87a | 159.43 |
| SE (±) | 7.78 | 10.28 | 9.78 | 25.73 |
| | NS | NS | | NS |
| CV (%) | 12.16 | 17.9 | 9.31 | 19.93 |

Means with a common letter are not significantly different at 5% level using Duncan's Multiple Range Test.

NS = Not Significant.

Table 4. Intercrop canopy width and height at 45 days after intercropping. Pod length and width at harvest

| CULTIVAR | CANOPY WIDTH (cm) | PLANT HEIGHT (cm) | AVERAGE POD LENGTH(cm) | AVERAGE POD WIDTH (cm) |
|---|---|---|---|---|
| TVX 2912-011D | 33.54 b[1/] | 28.68 | 13.79 | 0.69 |
| VITA 3 | 54.78a | 31.63 | 15.04 | 0.75 |
| TVX 1850-01E | 49.50a | 30.53 | 14.74 | 0.75 |
| TVX 3381-02F | 29.94 b | 25.35 | 12.81 | 0.70 |
| Laura B | 38.83 b | 32.61 | 14.88 | 0.63 |
| SE (±) | 5.9 | 3.21 | 1.20 | 0.64 |
| | | NS | NS | NS |
| CV (%) | 14.28 | 10.78 | 8.44 | 9.08 |

Means with a common letter are not significantly different at 5% level using Duncan's Multiple Range Test.

Data in Table 3 indicate that canopy width (Table 4) recorded at 45 days must have increased among cultivars to significantly affect tillering ($P < 0.05$) at 81 days. However, following final harvest and removal of intercrops areas, formely shaded by cowpea, resumed growth. This may be responsible for the non-significant rate of tillering recorded at 116 days.

A destructive harvest of sugarcane tillers at 88 days of intercropping, revealed that there was no significant differences in stem diameters between cultivars but significant tiller height differences were evident (see Table 5).

Table 5. The effect of intercropping sugarcane with cowpea cultivars on the growth of sugarcane tillers.

| INTERCROP CULTIVARS | TILLERS HEIGHT* (cm) (88 DAYS) | TILLERS HEIGHT (cm) (116 DAYS) | TILLERS DIAMETER* (cm) (88 DAYS) |
|---|---|---|---|
| TVX 2912-011D | 63.33ab | 68.83 | 3.13 |
| VITA 3 | 66.45a | 72.77 | 3.12 |
| TVX 1850-01E | 54.21 c | 63.91 | 3.07 |
| TVX 3381-02F | 63.83a | 70.89 | 3.11 |
| Laura B | 55.71 bc | 74.59 | 3.12 |
| | | NS | NS |
| SE (_) | 4.49 | 8.64 | 0.10 |
| CV (%) | 7.40 | 12.31 | 3.30 |

Means with a common letter are not significantly different at 5% level using Duncan's Multiple Range Test.

* Destructive harvest of sugarcane tillers.

NS = Not Significant.

Shading of the cultivars VITA 3, TVX 3381-02F and TVX 2912-011D may have been responsible for the reduced tiller number recorded at 81 days. The significant differences observed in heights of tillers intercropped with these cultivars could be due to the increased investment of nutrients in the growth of already established tillers rather than in the production of new tillers.

## DIFFERENCES IN SOIL PROPERTIES FOLLOWING INTERCROPPING

Chemical properties of the soil Ph, EC, P, K, Ca and Mg were not significantly affected by intercropping with the cowpea cultivars. However, following inter cropping a 58% increase in nitrogen levels of the soil (0.08 to 0.126%) were

observed. RAO, M. (1978) also reported increases of soil nitrogen levels following sugarcane intercropping on a different soil type in Jamaica.

## DISEASES OF INTERCROPS

Cowpea Mosaic Virus (CPMV) a major disease responsible for reducing cowpea production in Jamaica, was not a problem. The symptoms of this viral infection among cultivars in this trial was low, being only 2.2% in the field at 45 days following planting. Powdery mildew was observed mainly on Laura B during the latter stages of its growth.

## CONCLUSSIONS

As indicated by the recorded results, parameters such as growth habit, days to fifty percent flowering (D.F.F.), shelling or treshing percentage and effect on tillering must be among the important considerations, in the choice of cowpea cultivars, suitable for intercropping with sugarcane. In addition, red and tan-seeded cultivars, which are more acceptable to Jamaican consumers, merit further investigations.

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