# ANNUAL REPORT

Covering period September 1, 1990 to August 31, 1991

Submitted to the Office of the Science Advisor
US Agency for International Development

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Project Number: 936-5542.08

Grant Number: AID.492-5542-G-SS-8130-00

AID Grant Project Officer: Marilyn B. Buchan

Project Duration: Sept. 1988 to Dec. 1992

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## EXECUTIVE SUMMARY

The ultimate objective of the project is to obtain data on voluntary intake, growth, milk production, physiological responses, tick counts and economic evaluation of stylo mixed pasture vis-a-vis grass pasture. The first two years of the project were spent to identify the most suitable of stylo and grass in mixed pasture that could control ticks as well as could sustain animal's feed requirements. Our results strongly suggested that the mixture of seca and andropogon was the best in terms of yield, stylo persistency as well as tick larva trapping ability. On the other hand, guinea grass - the most adapted improved grass species in the Philipppines - was found to be the most productive but not able to trap larvae in our study. We therefore came up with a simple paired comparison design for the grazing trials: seca-andropogon as the anti-tick pasture vs guinea grass as the control. We ran two separate experiments involving growing heifers in one and lactating cows in the other. The heifer trial is about to complete while the lactation study has just been started.

Tentative results of the heifer grazing trial indicated that while higher forage dry matter (DM) and digestible DM intake were obtained with the guinea grass group, much better liveweight gain was observed from the seca-andropogon treatment. The poorer growth rate of the control group in spite of its higher feed consumption is attributed to the much higher tick load, hence the loss of nutrients due to parasitism.

## SECTION I

### A. RESEARCH OBJECTIVES

1. General:

The project aims at determining kinds of mixed grass-stylo vegetations suitable for biological control of bovine ticks and responses of dairy cattle grazing such a pasture.

2. Specific:

a. To identify promising/adapted species/cultivars of grasses and legumes able to trap tick larvae;

b. To determine survival rates of tick larvae at varying durations in pure and mixed vegetations;

c. To determine yield, botanical composition and nutritive values of stylo and grass species in pure and mixed stands with varying fertilization rates; and

d. To determine performance of dairy cattle grazing pastures with and without tick larvae-killing stylo, viz. tick count, cost of tick control, health status, growth rate, milk production and reproductive efficiency.

### B. RESEARCH ACCOMPLISHMENTS

Methodology

Detailed methodology has been described in the 1989's annual report. Brief description of the methodology for those experiments contained in this report is given.

Study 1 - Tick larva trapping ability of live stylos in pots

Tick larvae trapping ability of three stylo species (*S. scabra* #34925, *S. Scabra* seca #40202 and *S. viscosa*) at 4 exposure times (1,4,8 and 16 days) was studied following a 3 x 4 factorial arrangement in CRD. Ten days old tick larvae in plastic vials were released into a paper pouch w/ bridge attached to the base of a live stylo in the pot. The stylos were 18 months old and exposed to field conditions. Destructive sampling and counting of larva that were either free or trapped at the upper, middle and base parts of the plant were done after 1,4,8 and 16 days exposure.

Study 2 - Productivity of larva trapping stylos and grasses in pure and mixed vegetations

In three separate factorial experiments involving 2m x 5m plots replicated three times, four grass species, six stylo cultivars, and four seca-grass mixtures were tested against three fertilization rates of either nitrogen (grasses alone) or phosphorous (stylos alone and mixed vegetations). This two-year study has been completed.

Study 3 - Comparative digestibility of seca/andropogon by sheep and goats

Five goats and five sheep were used in a 5 x 5 Latin square involving five treatment rations to study digestibility of seca as the sole diet or as a supplement to andropogon diets.

Study 4 - Performance of dairy cattle grazing anti-tick pasture

This on-going study consists of two separate experiments, one dealing with replacement heifers and the other with lactating cows. For both experiments, 12 animals were randomly allotted to two kinds of pasture, e.g. guinea as control and seca andropogon as anti-tick pasture.

Percentage of Accomplishments

Objectives a, b, c and d have been 100%, 40%, 100% and 20% accomplished, respectively.

Study 1 - Tick larvae trapping ability of live stylos in pots

Total larva count

There are wide variations in the number of larva counted either trapped or free as shown in Table 1. Differences in egg hatchability and possible influence of rainfall that occurred when the experiment was conducted seemed to be the factors responsible for such variations.

Table 1. Total number of larvae

| SPECIES | LENGTH OF EXPOSURE (days) 1 | 4 | 8 | 16 | MEAN |
|---|---|---|---|---|---|
| *S. scabra* #34925 | 317 ±184 | 307 ±114 | 185 ±67 | 79 ±29 | 222[b] |
| *S. scabra* seca #40292 | 490 ±183 | 565 ±124 | 421 ±194 | 357 ±78 | 458[a] |
| *S. viscosa* | 149 ±101 | 209 ±157 | 75 ±27 | 63 ±23 | 124[c] |
| MEAN | 319 ±186[a] | 361 ±197[a] | 227 ±184[ab] | 179 ±154[b] | |

Total larva count significantly decreased with increasing exposure times. This suggested the presence of trap-shyness which prompted some tick larva to move away from sites where their companions were effectively immobilized by plant exudates and/or would not further ascend due to plant trichomes. Some tick larvae may have climbed down to ground level or washed down by rainfall.

Table 2. Proportion of free and trapped larvae on plants and different exposure times

| | LENGTH OF EXPOSURE (days) | | | |
|---|---|---|---|---|
| | 1 | 4 | 8 | 16 |
| Upper stem | | | | |
| % trapped | 26.79 b | 28.81 b | 33.13 a | 34.38 a |
| % free | 3.25 | 2.71 | 12.25 | 14.89 |
| Middle stem | | | | |
| % trapped | 43.89 a | 48.39 ab | 41.62 b | 38.62 b |
| % free | 26.07 | 20.08 | 12.99 | 12.11 |
| Whole plant | | | | |
| % on upper stem | 30.19 | 30.54 | 46.96 | 47.07 |
| % on middle stem | 69.81 | 69.46 | 53.04 | 52.93 |
| % trapped | 70.26 | 77.66 | 72.70 | 70.10 |
| % free | 29.74 | 22.34 | 27.30 | 29.90 |

Row means with different superscripts are significantly different ($P<0.05$).

Distribution of larvae on plant parts at different exposure times are presented in Table 2. The number of free larvae expressed as percentage of total count was significantly higher

in the upper stem after the 8th and 16th day of exposure while that in the middle was significantly lower. This showed that some free larvae in the middle stem continued their climb to the upper stem after the 4th day resulting in the increase of the percentage of free and/or trapped larva in the upper stem and decrease in the middle stem. Percentage of trapped larva was higher than free larva at all exposure times and a high percentage of larva either trapped or free was found in the middle stem.

Table 3. Proportions of free and trapped larvae on plant parts of three stylo species

| | *S. scabra* #34925 | *S. scabra* seca #402 | *viscosa* | CV,% |
|---|---|---|---|---|
| Upper stem | b | b | a | |
| % trapped | 19.28 | 21.60 | 55.30 | 30.21 |
| % free | 6.95 | 4.86 | 9.99 | 43.26 |
| Middle stem | a | a | a | |
| % trapped | 47.82 | 48.27 | 30.53 | 25.86 |
| % free | a 25.95 | a 25.28 | b 4.18 | 31.59 |
| Whole plant | b | b | a | |
| % on upper stem | 26.71 | 27.00 | 64.65 | 27.10 |
| % on middle stem | a 73.29 | a 73.01 | b 35.35 | 20.01 |
| % trapped | b 66.43 | b 68.86 | a 82.99 | 12.40 |
| % trapped | 33.57 | 31.14 | 17.01 | 23.10 |

Row means with different superscripts are significantly different ($P<0.05$).

Table 3 shows the proportions of free and trapped larva on plant parts of three stylo species. Percentage of trapped larva was significantly higher than free larva on all the species studied. *S. viscosa* appears to trap a significantly high percentage (82.99) of larva as compared to the other two species (66.43 and 68.86) and most of the larvae were trapped on the upper stem.

Study 2. Productivity of larva trapping stylos and grasses in pure and mixed vegetations

Results of the three experiments on dry matter yield are summarized in Table 4 and Fig. 1.

Table 4. Main effect means for dry matter yield of selected grasses and stylos in pure and mixed vegetations

| Tons/ha/Cutting | | | | | |
|---|---|---|---|---|---|
| 1. Pure grass plots | | | | | |
| Species | | | | Season | |
| Andro | Guinea | Setaria | Para | Dry | Wet |
| a | b | c | d | b | a |
| 480 | 4.11 | 3.68 | 2.84 | 3.32 | 4.39 |
| 2. Fertilizer effect | Nitrogen (kg/ha/year) | | | | |
| | 0 | 60 | 120 | | |
| | c | b | a | | |
| Grasses | 3.54 | 3.85 | 4.18 | | |
| | Phosphorus (Kg/ha/yr) | | | | |
| | 0 | 60 | 90 | | |
| | a | a | a | | |
| Stylos | 3.83 | 3.88 | 3.88 | | |
| | a | a | a | | |
| Mixed | 4.24 | 4.12 | 4.15 | | |

Main effect means without a common superscript are different ($P<0.05$).

The grass species differed ($P<0.05$) from one another in dry matter (DM) yield, the highest yielder was Andropogon, followed by Guinea, Setaria and lastly Paragrass. Significantly higher yield was obtained in the wet compared to dry seasons (4.39 vs 3.32 T/harvest). The superiority in yield of Andropogon, coupled with its ability to trap larvae as indicated in last year's report made this species an attractive companion of Seca in mixed pastures.

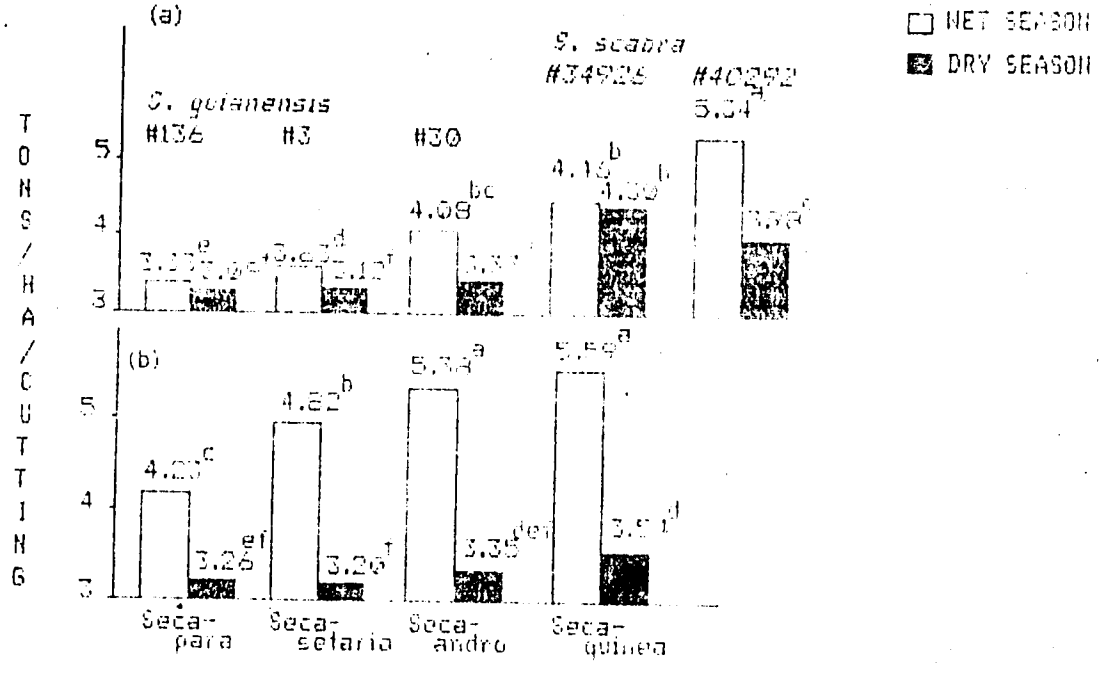


Figure 1. Interaction between season and species for pure stylos (a) and mixed vegetations (b) in dry matter yield

While the grasses significantly ($P<0.05$) increased DM yield with increasing N fertilization rate, the pure stylos and the mixed stands did not respond to phosphorus fertilization in spite of low phosphorous content of the soil in the experimental area (6.2 ppm). The absence of response to P fertilization in this experiment is not readily understood.

Interactions between forage species and season were found significant ($P<0.05$) for the pure stylo and the mixed vegetations. The scabra cultivars were better yielders compared to the guianensis in both the dry and wet seasons except for cultivar IPB #30 which excelled the other two guianensis cultivars and was comparable to *S. scabra* cv #34926 during the wet season. For all (except cv #34926) cultivars, higher yield was obtained from the wet season. This is a good indication that *S. scabra* cv #34926 is probably a drought resistant cultivar. For the mixed plots, dry season yield being similar in all mixtures (except for a higher yield of Seca-Guinea) was lower ($P<0.05$) compared to that of the wet season which saw highest yield with Seca Guinea and Seca-Andro, followed by Setaria-Seca and the poorest, Seca-Para ($P<0.05$).

Nutritive values of the grasses and stylos are shown in Table 5. Among the grasses, setaria was found to be the most succulent with lowest DM content and highest digestibility. While cell wall component was similar among the species, the lower yielders (Setaria and Para) were found to have higher CP content and digestibility value compared to the higher yielders

(Guinea and Andropogon). For the legumes, the Scabra cultivars were higher in DM, lower in CP and similar in other nutritive values including digestibility compared to the guianensis cultivars.

Table 5. Nutritive values of selected grass species and stylo cultivars

| | Dry Matter | Crude Protein | Cell Wall | Ash | Digestibility |
|---|---|---|---|---|---|
| | | | % dry matter | | |
| 1. Grass | | | | | |
| Para | 27.1 | 6.9 | 70.0 | 11.9 | 46.4 |
| Setaria | 15.4 | 6.8 | 69.8 | 13.1 | 49.9 |
| Guinea | 27.2 | 6.6 | 72.0 | 12.7 | 47.3 |
| Andropogon | 28.5 | 6.0 | 70.8 | 10.1 | 42.7 |
| 2. Stylo | | | | | |
| *S. scabra*, | | | | | |
| seca | 34.7 | 13.7 | 46.8 | 8.1 | 55.8 |
| #34925 | 33.4 | 13.5 | 45.2 | 7.9 | 54.4 |
| *S. guianensis*, | | | | | |
| #30 | 30.1 | 15.5 | 44.8 | 8.1 | 56.2 |
| #136 | 30.9 | 15.7 | 44.9 | 8.1 | 56.6 |
| #3 | 31.7 | 15.3 | 45.9 | 7.8 | 54.8 |

The value of stylo in the mixed pastures can only be appreciated as a means for tick control as well as for improved nutrition of the grazing animals if the legume persists. Figure 2 shows the comparative percentages of stylo in the mixtures with the four species of grass. While Andropogon and Paragrass were considered as equally favorable companion with stylo which was less persistent in the mixture with Setaria. Seca stylo was

found least persistent in the mixture with guinea grass which gradually reduced the seca proportion from 70 to less than 10% after one year of existence.

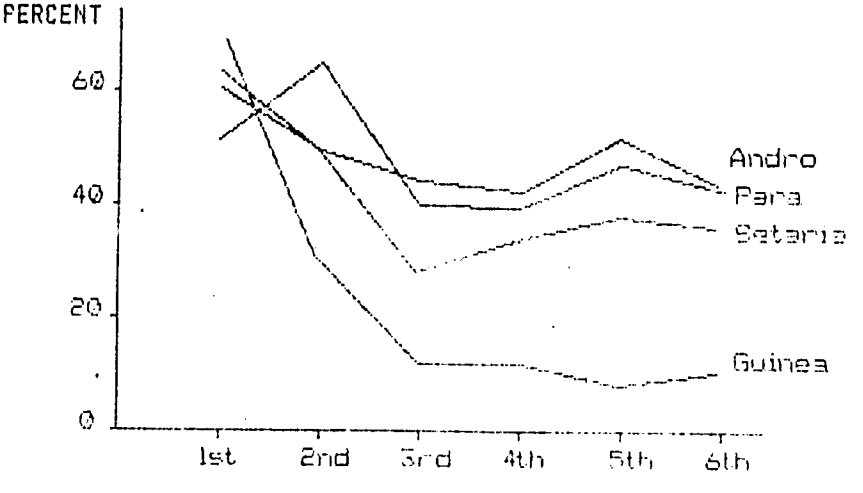


Figure 2. Proportions of seca stylo in mixed vegetations with four different grass species after six cuttings

## Study 3. Comparative digestibility of seca/andropogon by sheep and goat

Selected parameters of the digestion trials which were conducted in the dry season of 1991 are presented in Table 6. Sheep consumed more dry matter and digested the feed better than did goats, although the differences were not significant. Dry matter intake significantly ($P<0.05$) increased when andropogon was supplemented with seca at 0.5 and 1.0% liveweight (LW). Further increase in seca supplementation to 1.5% LW resulted in slight decrease in DM intake which was not significantly different from that of seca or andropogon alone diet.

Table 6. Dry matter intake and digestibility of seca stylo as the sole diet or as a supplement to andropogon grass with sheep and goats.

| | Dry Matter | |
|---|---|---|
| | Intake g/kg$^{.75}$ | Digestibility % |
| **Species** | | |
| Goats | 73.8 | 56.8 |
| Sheep | 77.6 | 59.5 |
| **Diets** | | |
| Andropogon alone | 69.6$^{b}$ | 59.9 |
| Andro + Seca (0.5% LW) | 78.6$^{a}$ | 55.5 |
| Andro + Seca (1.0% LW) | 79.7$^{a}$ | 58.8 |
| Andro + Seca (1.5% LW) | 77.0$^{ab}$ | 56.4 |
| Seca stylo alone | 74.5$^{ab}$ | 60.2 |

Main effect means without common superscript are different ($P<0.05$).

## Study 4 - Performance of dairy cattle grazing anti-tick pasture

Selected parameters obtained from the on-going experiment with the heifers are shown in Table 7. While higher forage DM

Table 5. Performance of growing dairy heifers grazing guinea and anti tick seca-andropogon pastures (wet season, 1991)

| | Guinea | Seca Andro |
|---|---|---|
| Daily dry matter (DM) intake, kg | | |
| DM | 7.7 | 6.4 |
| Protein | 0.69 | 0.73 |
| Digestible DM | 4.39 | 4.01 |
| Engorged tick count/hd/21days | 57 | 37 |
| Acaricide application numbers | 8 | 1 |
| Average daily gain, kg | 0.13 | 0.44 |

intake and digestible DM intake were observed with the guinea grass group, much better liveweight gain was observed from the seca-andropogon group. The poorer growth rate of the control group in spite of its higher feed consumption is attributed to the much higher tick load, hence the loss of nutrients due to parasitism. In this experiment and so with the lactation study, we adopted threshold method of acaride application (instead of the 21-day interval prophylactic spraying) for both groups of animals, i.e. spraying with acaricide was done only when engorged tick load reached approximately 100 per animal. It can be noted in Table 5 that while the control needed eight sprayings, only one acaricide application was done on the seca-andropogon group.

## C. SCIENTIFIC IMPACT OF COLLABORATION

This research project is being undertaken solely by scientists at the DTRI-UPLB. In the preparatory phase, however, the service of an entomologist from CSIRO, Australia (Dr. Robert Sutherst) has been tapped to strengthen the methodology of the research.

## D. DESCRIPTION OF PROJECT IMPACT

At this stage, it is still too early to expect any application of the findings. We nevertheless, are encouraged by the findings reported herein and hope that more concrete data will be obtained at the end of the project for possible adoption by end--users.

## E. STRENGTHENING OF DEVELOPING COUNTRY INSTITUTIONS

Please see last year's report.

## F. FUTURE WORK

The following experiments are being conducted and are expected to last through 1992:

1. Survival rates of tick larvae in pure and mixed vegetations
2. Grazing trial with growing heifers
3. Grazing trial with lactating cows

As mentioned in last year's report, because of weather conditions, the grazing trial was delayed by 6 months. For this year, part of the fence was broken by grazing animals, leading to destruction of about 1/3 ha of the experimental pasture. This was further aggravated by heavy monsoon rains, resulting in further damage, hence the need for replanting the destroyed portions. This means further delay of the implementation of the lactation trial.

## SESSION II

A. Managerial Issues: No problems

B. Budget: No major changes

C. Special Concerns: Not applicable

D. Collaboration, Travel, Training and Publications:

As described earlier, the project is being undertaken solely by DTRI-UPLB, there has been no collaboration so far. Likewise, no travel, training activities and publications have taken place. Nevertheless, information generated by the project has been used in the preparation of a professorial lecture of the Principal Investigator entitled "*Stylosanthes* for improved nutrition and biological control of grazing cattle" which has been delivered at the Animal Science Faculty and Graduate Seminar.

E. Request for AID or BOSTID actions:

We would like to request that, because of the weather and some technical problems mentioned earlier, the project be extended for one more year.

This extension will not involve any additional funds because we expect to have some savings from the approved budget at the end of 1992.

The additional one year is vital for the project to gather most important data on the responses of the grazing cows.