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## CONTENTS

# ABSTRACTS

## PERFORMANCE OF FORAGE SORGHUM HYBRIDS AND KATHERINE PEARL MILLET AT BUBIA.

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It is suggested that for efficient utilization, such material would have to be cut and fed, rather than grazed.

### ERRATA.

In the *Papua and New Guinea Agricultural Journal*, Vol. 21, No. 1, June, 1969, on first and second pages of Abstracts, the following lines should appear :—

1. Under the heading Performance of Forage Sorghum Hybrids and Katherine Pearl Millet at Bubia, insert G. D. Hill, 1969. *Papua and New Guinea agric. J.*, 21 (1) : 1-6.
2. Under the heading Performance of Grain Sorghum Hybrids at Bubia, insert G. D. Hill, 1969. *Papua and New Guinea agric. J.*, 21 (1) : 7-9.
3. Under the heading Grazing Under Coconuts in the Morobe District, insert G. D. Hill, 1969. *Papua and New Guinea agric. J.*, 21 (1) : 10-12.
4. Under the heading Control of *Cycas circinalis* with Tordon 50-D, insert G. D. Hill, 1969. *Papua and New Guinea agric. J.*, 21 (1) : 13-15.
5. Under the heading Murine Mange Due to *Myocoptes musculinus* (Acarina : Listrophoridae) in Laboratory Mice in Papua, insert N. T. Talbot, 1969. *Papua and New Guinea agric. J.*, 21 (1) : 16-20.

Page 21 has been deleted and will be reprinted under the title, Rubber Planting Recommendations 1969-70 in a future issue.

## GRAZING UNDER COCONUTS IN THE MOROBE DISTRICT.

In the Morobe District near Lae about 2,300 head of cattle are being grazed under coconuts on native pastures dominated by *Paspalum conjugatum* and *Calopogonium mucunoides*. On all properties some pasture improvement has been carried out. Grasses tried include *Brachiaria mutica, B. ruziziensis, Pennisetum purpureum, Panicum maximum, Panicum maximum* var. trichoglume. Legumes planted were *Centrosema pubescens, Dolichos lablab, Leucaena leucocephala, Phaseolus atropurpureus,* and *Pueraria phaseoloides*. In general fertilizer has not been applied to pastures. Carrying capacity on most properties was in the vicinity of one beast per acre. Cattle carried in nearly all cases were Brahman crosses with about 50 per cent. Brahman blood. Cost of fencing varied from $500 per mile to $217 per mile depending on materials used.

[*continued overleaf*]

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It is suggested that for efficient utilization, such material would have to be cut and fed, rather than grazed.

## PERFORMANCE OF GRAIN SORGHUM HYBRIDS AT BUBIA.

Three hybrid sorghums from Queensland, of open head type, Texas 608, Texas 626, Pioneer 846 and the segregating seed of Texas 610, were grown in a trial near Bubia. All hybrids yielded more than twice the yield of the segregating variety in the plant crop. The best varieties, Texas 608 and Texas 626, yielded more than a ton of grain to the acre.

The plants were allowed to ratoon, and plots were split for nitrogen fertilizer application, 100 lb. of nitrogen as sulphate of ammonia being applied. Highly significant responses to the fertilizer were obtained, but these were not expressed in grain yield because of the attack of sorghum midge (*Contarina sorghicola*) and sorghum rust (*Puccinia purpurea*). It is suggested that, because of the build-up of plant pathogens and insect pests in the ratoon crop and volunteer plants, a ratoon crop should not be taken and that all crop residues should be destroyed by burning.

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*[continued overleaf]*

# ABSTRACTS

## CONTROL OF CYCAS CIRCINALIS WITH TORDON 50-D.

The toxic plant *Cycas circinalis* can be eliminated from pastures by cutting off the top of the plant and pouring 2 ml. of Tordon 50-D concentrate into a small hole in the pithy core of the trunk. Cost of chemical is less than one cent per plant.

## MURINE MANGE DUE TO MYOCOPTES MUSCULINUS (ACARINA : LISTROPHORIDAE) IN LABORATORY MICE IN PAPUA.

Murine mange due to *M. musculinus* was recorded from laboratory mice in Papua and New Guinea for the first time. A considerable difference in pathogenicity was reported between two unrelated strains of mice. The condition was controlled by treatment of all animals with .02 per cent. Tetmosol solution.

# PERFORMANCE OF FORAGE SORGHUM HYBRIDS AND KATHERINE PEARL MILLET AT BUBIA

G. D. HILL.*


## ABSTRACT.

*Six varieties of forage sorghum and the Katherine variety of Pearl millet were grown at Bubia. Highly significant responses in yield were obtained from the use of 100 lb. of fertilizer nitrogen as sulphate of ammonia.*

*The highest yielding variety was Sudax which, with fertilizing, yielded more than 12,000 lb. of dry matter per acre at 12 weeks from planting. The mean at 12 weeks for all fertilized varieties was 9,200 lb. of dry matter per acre and 5,000 lb. dry matter per acre for unfertilized varieties at the same age.*

*Crude protein levels fell from 22.77 per cent. at four weeks to 7.07 per cent. at 12 weeks on a dry weight basis.*

*It is suggested that for efficient utilization, such material would have to be cut and fed, rather than grazed.*


## INTRODUCTION.

In recent years a number of forage sorghum hybrids have been released by seed firms in Australia. Although one of these, Sudax, had been grown in pastures at Munum and Erap, no assessment of yield potential had been made under Territory conditions. Norman and Wetselaar (1960) reported Katherine Pearl millet to be an outstanding fodder plant in trials conducted at Katherine in the Northern Territory.

A trial was laid down at Bubia to assess production of six different forage sorghum hybrids and the Katherine variety of Pearl millet under wet tropical lowland conditions.

## MATERIALS AND METHODS.

The following six forage sorghum hybrids were obtained from various seed firms in Australia :—Bonanza, Calala, Forager, Sudax, Suhy 5 and Trudan. At the same time the Katherine strain of Pearl millet (*Pennisetum typhoides*) was obtained.

The treatments were—

| | |
|---|---|
| Bonanza— Calala Forager | No fertilizer |
| Katherine Pearl millet— Sudax Suhy 5 Trudan. | 100 lb. N/acre (as sulphate of ammonia) |

A split block randomized design with four replicates was utilized. The trial was sown on the 18th July, 1968, at Bubia in a light brown clay loam. Varieties were sown at a rate of 10 lb. per acre in main plots 90 ft. x 12 ft., each plot having four rows 3 ft. apart.

Blocks were split for nitrogen, which was applied as a side dressing in a split application of 50 lb. of N as sulphate of ammonia on each occasion ; the first, one week after planting, and the second, three weeks after planting.

The plots were sampled at 4, 8, 12, and 16 weeks after sowing. Three random lengths of 1 yd. were cut from the centre two rows of each sub-plot at each harvest, the same section of row never being resampled. These were bulked and weighed green. A 1 Kg. sub-sample was taken from each sample and dried to constant weight in a forced draft oven at 85 degrees C. Dried samples of all replicates of each variety were bulked and ground for crude protein analysis.

## RESULTS AND DISCUSSION.

### *Progress of Trial.*

All varieties showed very marked visual responses to nitrogen ; plants were taller and had more leaf which was darker green in colour

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than unfertilized plants. Growth of Katherine Pearl millet was not as rapid as that of any of the forage sorghums.

Forager, Bonanza, Sudax and Calala were all flowering by the time the plants were 8 weeks of age. All other varieties flowered before the 12 week harvest.

Although there was only slight infection with sorghum rust at 8 weeks, this became more severe by the 12 week harvest and was noticeably more prevalent on plants which had received nitrogen treatments. Katherine Pearl millet, not being a sorghum, was not affected.

By the 16 week harvest, there was a considerable degree of lodging in nitrogen-treated plots, the varieties Suhy 5 and Trudan being less prone to lodging than the others.

Rainfall, mean maximum and minimum temperatures and average hours of sunshine at Bubia during the period of the trial are shown in *Table* 1.

### *Dry Matter Production.*

The mean dry matter production for all varieties for both treatments at all harvests is shown in *Table* 2. *Figure* 1 shows the production of individual varieties with added fertilizer nitrogen. As can be seen, the best variety, Sudax, yielded more than 12,000 lb. of dry matter per acre at 12 weeks.

The noticeable decline in yield of Sudax, Bonanza, Calala and Forager between the 12 and 16 week harvests was probably caused by plants reaching maturity at some point between these two harvests and senesence setting in. Quite apart from considerable loss of quality with age, allowing sorghum to grow beyond 12 weeks would appear to lead to diminished yields.

In *Figure* 2 the mean values are plotted for all varieties, with and without nitrogen. Not only was the absolute production of material far greater with added fertilizer nitrogen (9,200 lb. and 5,000 lb. per acre respectively), but growth of fertilized varieties was far more rapid. At 8 weeks the average production from fertilized plants was in excess of the production from unfertilized plants at 12 weeks. At all harvests the responses to nitrogen were very highly significant ($P<0.001$).

FIGURE 1.

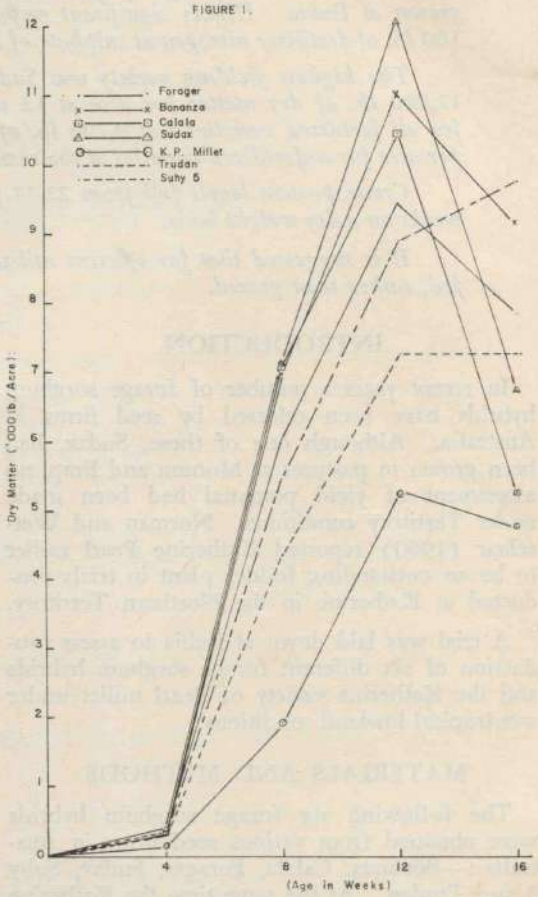
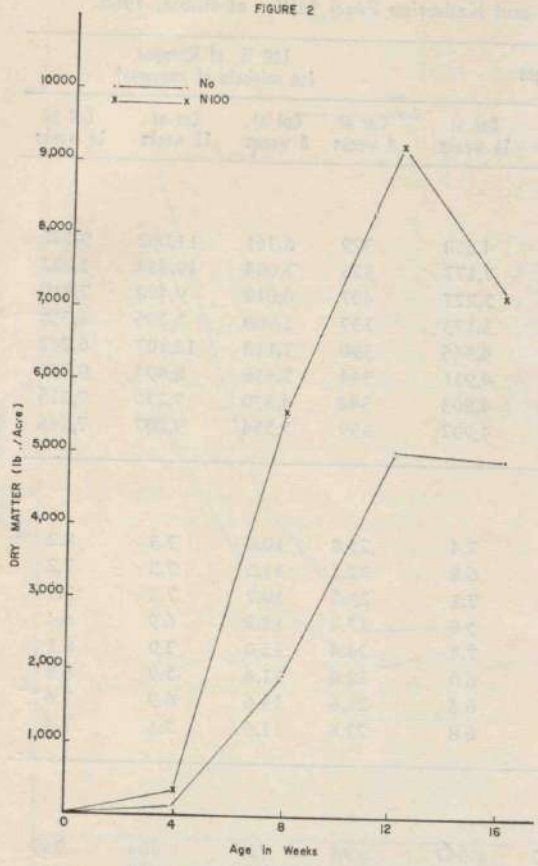



*Table* 1.—Meteorological Data at Bubia, July-November, 1968.

| — | July | Aug. | Sept. | Oct. | Nov. | Total |
|---|---|---|---|---|---|---|
| Rainfall (inches) .... .... | 10.81 | 12.35 | 14.07 | 9.67 | 4.34 | 51.24 |
| Mean max. degrees F. .... .... | 85.9 | 88.1 | 88.9 | 89.5 | 89.7 | |
| Mean min. degrees F. .... .... | 69.6 | 70.4 | 69.5 | 70.4 | 71.2 | |
| Sunshine (hours)* .... .... | 3.1 | 4.9 | 6.0 | 5.9 | 6.0 | |

* Campbell Stokes recorder.

FIGURE 2




The differences between varieties were significant at the first and fourth harvests ($P<0.05$), and were very highly significant at the second and third harvests ($P<0.001$).

Only at the second harvest was the varieties by nitrogen interaction significant ($P<0.05$). Therefore, in general, the seven varieties were responding in a similar manner to the added fertilizer nitrogen.

*Crude Protein Levels.*

The crude protein levels at different harvests for the various varieties with and without nitrogen are shown in *Table* 2.

In *Figure* 3 are plotted the crude protein levels for fertilized plots of all varieties.

The mean value fell from 22.77 per cent. at 4 weeks to 7.07 per cent. at 12 weeks. The small rise in protein levels between 12 and 16 weeks is probably due to sampling variation. On the basis of these figures, fertilized material at 8 weeks would be suitable forage for growing cattle, and 12 week material would be suitable for maintenance of mature animals. Whyte *et al.* (1959) give the crude protein requirement for maintenance of mature cattle as 6 to 6.7 per cent., and for growth, 10 per cent.

In *Figure* 4, the mean protein contents for all varieties, both fertilized and unfertilized, are plotted. The unfertilized plants had a consistently lower crude protein level than the fertilized plants. On the basis of the above values, the unfertilized material would have to be grazed between 4 and 8 weeks to provide suitable forage for growing stock, and by 12 weeks would probably not even be suitable for maintenance of mature animals, unless supplemented with a suitable protein concentrate.

FIGURE 3

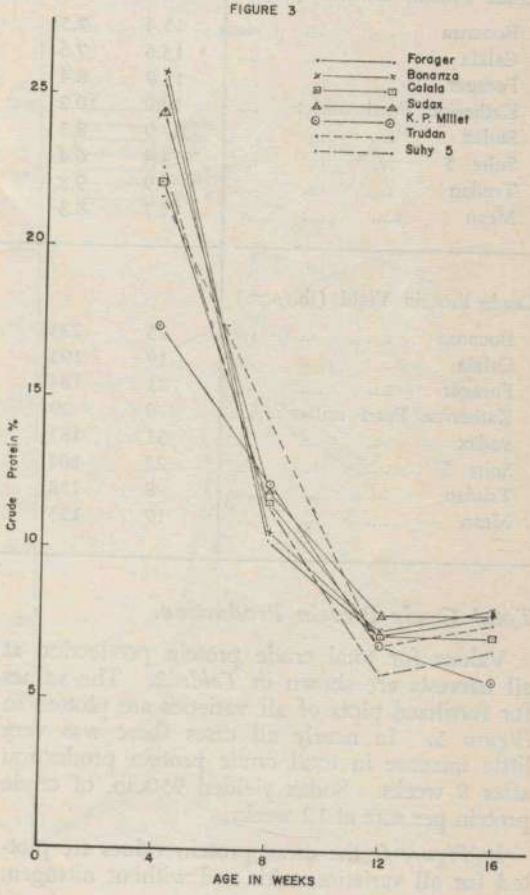


*Table* 2.—Production of Forage Sorghum Varieties and Katherine Pearl Millet at Bubia, 1968.

| Variety | No Nitrogen Treatment | | | | 100 lb. of Nitrogen (as sulphate of ammonia) | | | |
|---|---|---|---|---|---|---|---|---|
| | Cut at 4 weeks | Cut at 8 weeks | Cut at 12 weeks | Cut at 16 weeks | Cut at 4 weeks | Cut at 8 weeks | Cut at 12 weeks | Cut at 16 weeks |
| **Dry Matter Yield (lb./acre)** | | | | | | | | |
| Bonanza | 161 | 2,968 | 6,025 | 4,658 | 379 | 6,961 | 11,002 | 9,140 |
| Calala | 120 | 2,550 | 7,742 | 7,177 | 375 | 7,084 | 10,454 | 5,292 |
| Forager | 133 | 2,176 | 4,884 | 5,227 | 407 | 6,010 | 9,428 | 7,819 |
| Katherine Pearl millet | 62 | 285 | 2,059 | 3,173 | 137 | 1,900 | 5,296 | 4,756 |
| Sudax | 172 | 2,176 | 6,040 | 4,346 | 390 | 7,118 | 12,107 | 6,747 |
| Suhy 5 | 152 | 1,572 | 4,732 | 4,931 | 344 | 5,436 | 8,894 | 9,750 |
| Trudan | 76 | 1,626 | 3,745 | 4,803 | 340 | 4,370 | 7,270 | 7,216 |
| Mean | 125 | 1,908 | 5,032 | 4,902 | 339 | 5,554 | 9,207 | 7,246 |
| **Crude Protein Content (%)** | | | | | | | | |
| Bonanza | 15.4 | 7.5 | 6.1 | 7.4 | 25.8 | 10.6 | 7.3 | 8.2 |
| Calala | 15.6 | 7.6 | 6.4 | 6.8 | 22.1 | 11.5 | 7.2 | 7.2 |
| Forager | 15.9 | 8.4 | 5.5 | 7.1 | 25.5 | 10.2 | 7.2 | 7.9 |
| Katherine Pearl millet | 14.0 | 10.2 | 5.9 | 5.8 | 17.4 | 12.2 | 6.9 | 6.4 |
| Sudax | 17.9 | 8.3 | 5.9 | 7.4 | 24.4 | 12.0 | 7.9 | 8.1 |
| Suhy 5 | 14.4 | 6.4 | 5.2 | 6.0 | 22.6 | 11.4 | 5.9 | 6.8 |
| Trudan | 9.9 | 9.8 | 5.5 | 6.6 | 21.6 | 13.6 | 6.9 | 7.6 |
| Mean | 14.7 | 8.3 | 5.8 | 6.8 | 22.8 | 11.6 | 7.1 | 7.4 |
| **Crude Protein Yield (lb./acre)** | | | | | | | | |
| Bonanza | 25 | 223 | 365 | 347 | 98 | 739 | 804 | 749 |
| Calala | 19 | 193 | 498 | 489 | 83 | 815 | 758 | 384 |
| Forager | 21 | 184 | 269 | 372 | 104 | 616 | 684 | 621 |
| Katherine Pearl millet | 9 | 29 | 122 | 204 | 24 | 232 | 368 | 273 |
| Sudax | 31 | 181 | 359 | 320 | 95 | 854 | 954 | 548 |
| Suhy 5 | 22 | 101 | 246 | 296 | 78 | 619 | 528 | 658 |
| Trudan | 8 | 158 | 206 | 315 | 74 | 595 | 504 | 550 |
| Mean | 19 | 153 | 295 | 335 | 79 | 639 | 657 | 540 |

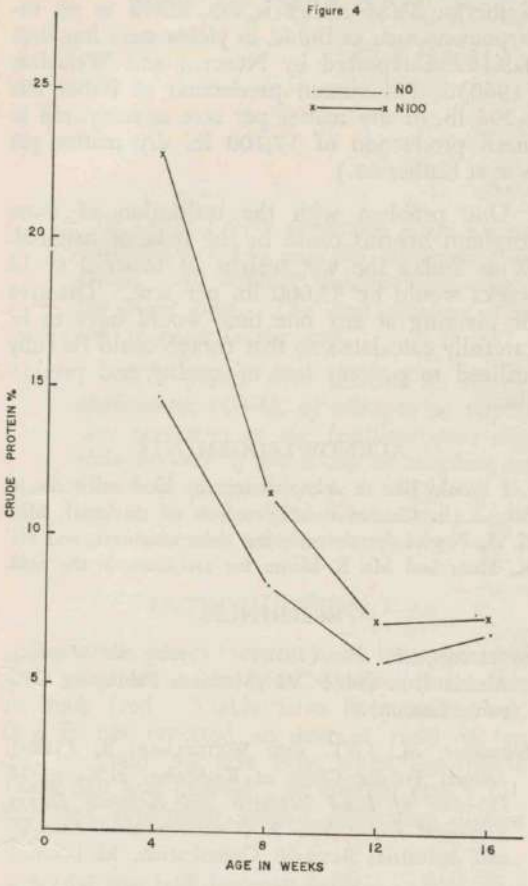
### *Total Crude Protein Production.*

Values for total crude protein production at all harvests are shown in *Table* 2. The values for fertilized plots of all varieties are plotted in *Figure* 5. In nearly all cases there was very little increase in total crude protein production after 8 weeks. Sudax yielded 950 lb. of crude protein per acre at 12 weeks.

In *Figure* 6, the mean protein values are plotted for all varieties, with and without nitrogen. The differences in the total production and the rate of production were very marked, the mean value for all fertilized varieties being 600 lb. per acre at 12 weeks, and the unfertilized plots reaching a maximum of 335 lb. per acre at 16 weeks.

### *Utilization.*

For good untilization the varieties tested would have to be grazed between 4 and 8 weeks of age. Plants at 8 weeks were about 10




ft. high. Grazing would therefore lead to considerable losses as a result of trampling, leading to incomplete untilization of available forage. Moreover, further production would be reduced.

It would appear that for good utilization, forage sorghums would have to be cut and fed to livestock. Fertilized material would be suitable for young animals until it reached an age of 8 weeks, and for use as maintenance rations for mature animals until it was 12 weeks old.

Morrison (1958) states that beef cattle weighing 1,000 lb. fed for rapid growth, require 18.6 to 21 lb. of dry matter per day. Taking the higher value, the mean production for one acre for all fertilized varieties at 8 weeks would give sufficient dry matter for 264 days' feeding. Sudax would provide sufficient matter for 399 days.

If the maintenance requirement for a mature animal weighing 2,000 lb. is taken, the daily dry matter intake requirement is 24.7 to 26.9 lb. of dry matter per day (Morrison 1958). Mature animals could be fed 12-week-old material and each acre would provide 342 days' feeding, using the average of all fertilizer treatments, or 450 days for Sudax.

### *Costs of Production.*

Hybrid forage sorghum seed from Australia costs about 29c per lb. and 100 lb. of N as sulphate of ammonia currently costs about $25 at Lae. Total costs of materials per acre would therefore be in the vicinity of $28 for fertilized sorghum or $3 for unfertilized. As other costs such as ground preparation and harvesting would be the same, the use of fertilizer nitrogen is fully economic and is strongly recommended.

FIGURE 5

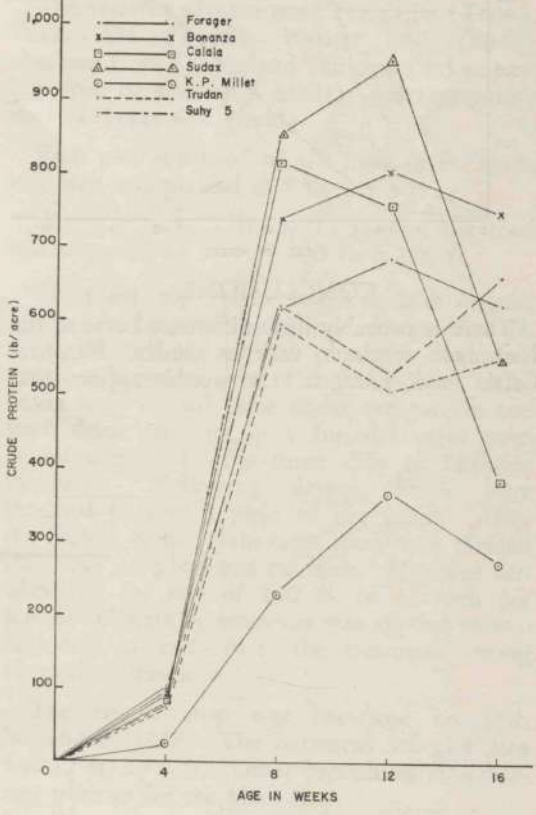
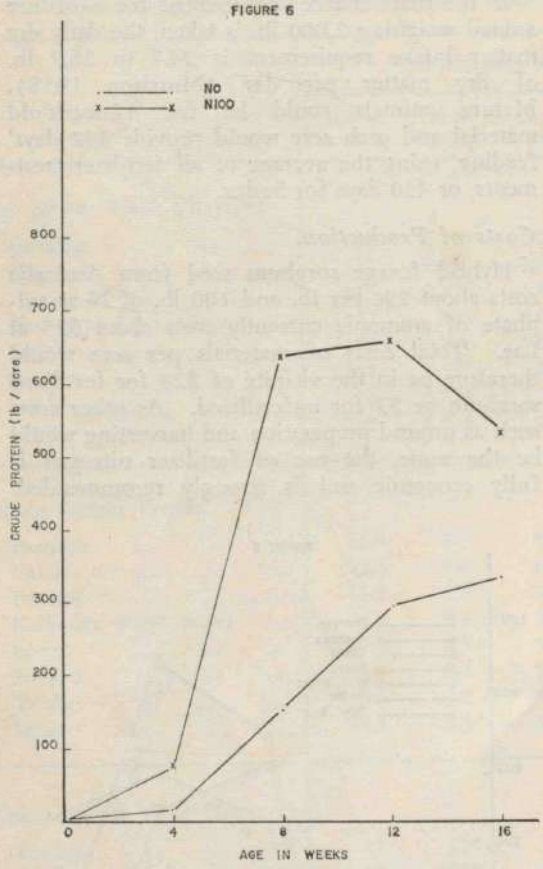


FIGURE 6




## CONCLUSIONS.

There is probably little difference between the four best sorghum varieties Sudax, Bonanza, Calala and Forager. It would appear that Katherine Pearl millet is not suited to an environment such as Bubia, as yields were less than half those reported by Norman and Wetselaar (1960). (Maximum production at Bubia was 5,296 lb. of dry matter per acre as compared to mean production of 12,100 lb. dry matter per acre at Katherine.)

One problem with the utilization of these sorghum hybrids could be the bulk of material. With Sudax the wet weight of material at 12 weeks would be 33,000 lb. per acre. The area of planting at any one time would have to be carefully calculated so that forage could be fully utilized to prevent loss of quality and production.

## ACKNOWLEDGEMENTS.

I should like to acknowledge the kind assistance of Mr. A. E. Charles in the analysis of this trial, Miss C. A. Fowler for the nitrogen determinations, and Mr. K. Moar and Mr. S. Meara for assistance in the field.

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(Accepted for publication April, 1969.)

# PERFORMANCE OF GRAIN SORGHUM HYBRIDS AT BUBIA

G. D. HILL.*


## ABSTRACT.

*Three hybrid sorghums from Queensland, of open head type, Texas* 608, *Texas* 626, *Pioneer* 846 *and the segregating seed of Texas* 610, *were grown in a trial near Bubia. All hybrids yielded more than twice the yield of the segregating variety in the plant crop. The best varieties, Texas* 608 *and Texas* 626, *yielded more than a ton of grain to the acre.*

*The plants were allowed to ratoon, and plots were split for nitrogen fertilizer application,* 100 *lb. of nitrogen as sulphate of ammonia being applied. Highly significant responses to the fertilizer were obtained, but these were not expressed in grain yield because of the attack of sorghum midge* (Contarina sorghicola) *and sorghum rust* (Puccinia purpurea). *It is suggested that, because of the build-up of plant pathogens and insect pests in the ratoon crop and volunteer plants, a ratoon crop should not be taken and that all crop residues should be destroyed by burning.*


## INTRODUCTION.

For some years, farmers have been growing grain sorghum in the Markham Valley for sale as stock feed. Yields have been quite low. One farmer reported an average yield of ten cwt. of grain per acre even when the hybrid Texas 610 was planted. In another case a farmer was replanting second generation hybrid seed.

A trial was laid down at Bubia—

1. to assess production from new open headed hybrids introduced from Queensland ; and
2. to demonstrate the futility of replanting segregated hybrid seed.

## MATERIALS AND METHODS.

The trial was planted at Bubia on a light clay loam on the 14th and 15th May, 1968. A randomized block design with four replicates was used.

The varieties planted were Texas 608 (T608), Texas 626 (T626), Pioneer 846 (P846) obtained from Queensland (all described as having open or semi-open heads), and segregating seed of Texas 610 (local).

Each plot consisted of six rows, 2 ft. apart, and seed was planted at 7 lb. per acre.

Plot size was 55 ft. by 12 ft. and the total trial occupied an area of 120 ft. x 118 ft.

The plant crop was harvested on 28th August, 1968. At harvest, the outside rows and 2 ft. 6 ins. of each end of each plot were discarded, giving a harvested area of 8 ft. by 50 ft. The heads were cut off close under the panicle and were dried on trays in a forced-draught oven at 50 degrees C. for three days to facilitate threshing. Following drying, heads were threshed to give a yield of dry grain. After the harvest of the plant crop, plots were divided into four sub-plots and cut back. Nitrogen fertilizer, at the rate of 100 lb. of nitrogen per acre as sulphate of ammonia was applied to two sub-plots in each plot, the treatments being allocated at random.

The ratoon crop was harvested on 15th November, 1968. The harvested sub-plot area was 12 ft. by 8 ft. Other procedures after harvest were as for the plant crop.

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## RESULTS AND DISCUSSION.

*Diseases and Pests.*

The plant crop was generally healthy but there was some damage caused by aphids, (*Aphis* sp.) which were controlled by Thiodan insecticide at recommended rates. In addition, *Heliothis* sp. attacked unripe grain in heads, and were controlled by D.D.T.

In the ratoon crop, the plants were attacked by sorghum midge (*Contarina sorghicola*). This insect is difficult to control and its presence was not realized until flowering was well advanced. Its attack led to considerable reduction of yield which is discussed more fully below.

In the plant crop, there was some attack by plant pathogens, in particular sorghum rust (*Puccinia purpurea*) and leaf spot (*Cercospora sorghi*). These did not appear to affect yields unduly. However, in the ratoon crop, because of carry-over of the pathogens on volunteer plants, rust infection was almost universal and of very severe incidence. It was particularly bad on nitrogen-fertilized plants.

## YIELDS.

*Plant Crop.*

The actual yield of the plant crop in lb. per acre is shown in *Table* 1.

*Table* 1.—Yield of Grain Plant Crop.

| Variety. | Mean Yield. lb./acre. | Significance. 5 per cent. level. |
|---|---|---|
| Texas 608 .... | 2546 ┐ | Any two means *not* enclosed in the same bracket are different at the 5 per cent. level. |
| Texas 626 .... | 2396 ┘ | |
| Pioneer 846 .... | 1919 | |
| Local .... | 844 | |

The analysis of varience for the plant crop is shown in *Table* 2.

*Table* 2.—Analysis of Variance—Plant Crop—Heads.

| Source. | d.f. | S.S. | M.S. | F. | Significance. |
|---|---|---|---|---|---|
| Varieties .... | 3 | 1,497 | 499.00 | 30.13 | *** |
| Blocks .... | 3 | 17 | 5.67 | 0.34 | N.S. |
| Error .... | 9 | 149 | 16.56 | | |
| Total .... | 15 | 1,663 | | | |

The threshing percentages for the first crop were :—

Local 44.28 per cent. ; T608 55.65 per cent. ; T626 55.0 per cent. ; and P846 49.65 per cent.

*Ratoon Crop.*

Visual responses to applied nitrogen were very marked ; fertilized sub-plots were greener and plants considerably larger. Fertilized sub-plots also came to head more rapidly than unfertilized sub-plots.

Yield responses to applied nitrogen were very highly significant ($P<0.001$).

Analysis of variance for the ratoon crop is shown in *Table* 3.

Unfortunately, these responses were not expressed in increased grain yield. The mean yields of grain from unfertilized and fertilized treatments are shown in *Table* 4.

It is interesting to make an assessment of the yields that would have been obtained had the midge and rust not attacked the crop. This can be done using threshing percentages from the plant crop. If this is done the estimated yields would be as shown in *Table* 5.

The most important point that emerges from this is the economic loss sustained by the farmer because of the presence of the midge and the rust. If a value of grain sorghum of $52 per ton at the farm gate is assumed, the loss per acre to the farmer in money terms is as shown in *Table* 6. This does not include the cost of added fertilizer.

## CONCLUSION.

Yields from the hybrids were quite good, the two best varieties in the plant crop yielding more than a ton to the acre on unfertilized land.

Responses to fertilizer nitrogen were very highly significant. However, because of the presence of the sorghum midge and rust, these were not expressed in the form of increased grain yields. At the level of fertilizer applied, increased yields were probably not economic. However, lower levels of fertilizer would still give increased yields and a trial is now in progress in the Markham Valley to assess more closely fertilizer requirements for grain sorghum.

*Table* 3.—Analysis of Variance—Ratoon Crop—Heads.

| Source. | d. of f. | S.S. | M.S. | F. | Significance. |
|---|---|---|---|---|---|
| Blocks .... .... .... .... | 3 | 1.360770 | .453590 | .... | .... |
| Varieties .... .... .... | 3 | 9.549105 | 3.183035 | 8.88 | ** |
| Error .... .... .... .... | 9 | 3.224930 | .358326 | .... | .... |
| Main plots .... .... .... | 15 | 14.134805 | 13.038171 | .... | .... |
| Fertilizer .... .... .... | 1 | 13.038171 | 13.038171 | 81.27 | *** |
| Var. x Fert. .... .... .... | 3 | 3.431896 | 1.1439653 | 7.13 | ** |
| Error .... .... .... .... | 12 | 1.925277 | .1604398 | .... | .... |
| Total .... .... .... .... | 31 | 32.530149 | .... | .... | .... |

*Table* 4.—Mean Yield Grain Lb./Acre Ratoon Crop.

| Variety. | Fertilizer Treatment. | |
|---|---|---|
| | N 0. | N 100. |
| Local .... .... .... | 576 | 599 |
| P846 .... .... .... | 393 | 421 |
| T608 .... .... .... | 668 | 590 |
| T626 .... .... .... | 536 | 1,040 |

*Table* 5.—Mean Yield of Grain Lb./Acre Ratoon Crop, Assuming Threshing Percentage of Plant Crop.

| Variety. | Fertilizer Treatment. | |
|---|---|---|
| | N 0. | N 100. |
| Local .... .... .... | 782 | 1,137 |
| P846 .... .... .... | 1,022 | 1,616 |
| T608 .... .... .... | 1,344 | 1,824 |
| T626 .... .... .... | 1,588 | 2,408 |

*Table* 6.—Estimated Loss as Result of Midge and Rust Attack.

| Variety. | Fertilizer Treatment. | |
|---|---|---|
| | N 0. | N 100. |
| | $ | $ |
| Local .... .... .... | 4.78 | 12.49 |
| P846 .... .... .... | 14.60 | 27.74 |
| T608 .... .... .... | 15.69 | 28.65 |
| T626 .... .... .... | 24.42 | 31.76 |

Although there is little doubt that a ratoon crop can be taken from sorghum in an environment with adequate rainfall, such as Bubia, this should not be done because of the build-up of plant pathogens and insect pests. Both these would probably be reduced by good crop hygiene and complete destruction of all crop residues by burning after harvest.

ACKNOWLEDGEMENTS.

The assistance of the following people in the conduct of this trial is gratefully acknowledged :—

Mr. A. E. Charles, for assistance with the design and analysis ; Dr. D. Shaw, for identification of plant pathogens ; Dr. C. S. Li, for insect identification ; and Mr. S. Meara for assistance in the field.

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# GRAZING UNDER COCONUTS IN THE MOROBE DISTRICT

G. D. HILL.*


## ABSTRACT.

*In the Morobe District near Lae about* 2,300 *head of cattle are being grazed under coconuts on native pastures dominated by* Paspalum conjugatum *and* Calopogonium mucunoides. *On all properties some pasture improvement has been carried out. Grasses tried include* Brachiaria mutica, B. Ruziziensis, Pennisetum purpureum, Panicum maximum, Panicum maximum *var. trichoglume. Legumes planted were* Centrosema pubescens, Dolichos lablab, Leucaena leucocephala, Phaseolus atropurpureus, *and* Pueraria phaseoloides. *In general fertilizer has not been applied to pastures. Carrying capacity on most properties was in the vicinity of one beast per acre. Cattle carried in nearly all cases were Brahman crosses with about* 50 *per cent. Brahman blood. Cost of fencing varied from* $500 *per mile to* $217 *per mile depending on materials used.*


## INTRODUCTION.

A major factor in the cost of copra production in the Territory is the control of grass in plantations. One possible means of reducing this cost is the conversion of excess grass into a saleable product in the form of beef. To achieve this, however, extra capital expenditure is required to provide fencing, watering points, stock yards and breeding cattle. Whether such expenditure would be economically justified would depend on the circumstances of a particular property, taking into account the expected saving in labour costs, the extra revenue from cattle sales, and the cost of equipping the beef cattle enterprise.

In this article the experiences of a number of copra/cattle producers in the Morobe District are described, so that other copra producers may consider this form of dual enterprise. Near Lae there is a ready market through the Lae Abattoir or in sales to newly developing cattle projects. In other districts which do not have such ready access to markets, growing of beef could also be considered as a replacement for tinned meat or fish in labour rations.

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At present about 2,300 head of cattle are being grazed under coconuts near Lae. The properties concerned vary in area from 350 acres to 2,500 acres; not all are fully planted to coconuts or fully stocked with cattle. Rainfall varies from more than 200 in. per annum at Singaua on the coast east of Lae, to 55 in. per annum at Maralumi, 35 miles to the north-west of Lae in the Markham Valley.

In general most of the properties are situated on soils derived from unsorted river alluvials; they may vary within very short distances from reasonably deep fine loam to gravelly loam.

## NATURALIZED GRASSES AND LEGUMES.

On all properties near the coast *Calopogonium mucunoides* and *Paspalum conjugatum* are dominant in natural pastures. At Maralumi, *Paspalum conjugatum* and *Imperata cylindrica* were originally present under coconuts, but they have now been almost entirely replaced by improved pasture species.

## INTRODUCED PASTURE SPECIES.

All properties have undertaken some pasture improvement. Grass species which have proved most suitable on the coast under coconuts are *Brachiaria mutica* (Para), *Pennisetum purpureum* (Elephant), and *Panicum maximum* (Guinea). At Malahang it was found that Elephant and Guinea could be utilized more fully if cut and

fed rather than grazed, as the large bulk of material produced made complete utilization by the grazing animals difficult. This problem may have been overcome by the use of smaller paddocks to allow a greater stocking density at the time of grazing. Similar problems with Elephant grass were encountered at Narakapor. At Maralumi, *Panicum maximum* var. trichoglume (Green Panic) has persisted satisfactorily under coconuts. *Brachairia ruziziensis* is proving satisfactory at Narakapor.

In all cases Elephant, *B. ruziziensis* and Para grass were established from cuttings. Guinea and Green Panic were established from seed sown at 1½ to 2 lb. per acre.

Improved legumes which have been sown under coconuts include *Centrosema pubescens* (Centro), *Dolichos lablab* (Dolichos), *Leucaena leucocephala* (Leucaena), *Phaseolus atropurpureus* (Siratro), and *Pueraria phaseoloides* (Puero).

All legumes were planted from seed. At Narakapor, *Dolichos lablab* was overgrazed and did not recover. However with good grazing management on another nearby property (not under coconuts), it persisted for two years. At Maralumi, Centro after some years became infected with Centrosema mosaic virus and disappeared from pastures. On the same property, a pure stand of Puero under coconuts failed to persist under grazing.

At Malahang the manager was not satisfied with the growth of forage on Leucaena in pastures. This was probably due to two factors—firstly the high palatability of Leucaena leading to its being grazed in preference to other species present and secondly large paddock size leading to low stocking density which did not allow sufficient time between grazings for the Leuceana to recover fully. At Narakapor, where paddock sizes are smaller, the manager was quite satisfied with the performance of Leucaena interplanted in hedges between coconuts

## FERTILIZER USAGE.

On most properties no fertilizer has been applied to pastures. At Malahang and Singaua, sulphur at the rate of two lb. of elemental sulphur per palm, has been applied to coconuts.

At Malahang, applications of one cwt. of sulphate of ammonia per acre have been made and the manager was of the opinion that cattle selectively grazed fertilized areas.

Visual responses were observed for two to three months after application. As the manager did not consider the property fully stocked, he thought that the practice was not at present warranted.

## CARRYING CAPACITY.

On all properties, the carrying capacity under coconuts was high ; on most, it was estimated as being better than a beast to the acre.

At Malahang, 750 head were carried on 1,000 acres. The manager considered the property was understocked. A stocking rate of a beast to the acre was possible on both native and improved pastures under coconuts but better weight gains were obtained from improved pastures.

At Singaua, 600 head were carried on 800 acres. At Awilunga grazing was also available on open pastures. The owner considered that the pastures under coconuts, which were mainly native species, would carry a beast to the acre. At Narakapor 140 head were being carried on 130 acres. At Maralumi, which has an annual rainfall of 55 in. per annum, and which is nearly all planted to improved species, a beast per acre was carried on legume/grass mixtures and a beast to two acres on pure legume stands.

## GRAZING MANAGEMENT.

Grazing management techniques varied from property to property and with pasture types. Some properties set-stocked native pasture, but most employed some degree of rotational grazing. Cycles varied from one week on-eight weeks off to four weeks on-six weeks off. All properties reported that under the grazing regime employed, improved species persisted with the exception of Dolichos and Puero, as mentioned above.

## WEED SPECIES.

All properties had some problems with weeds. On the coast the most important weed in pastures were ferns. At Singaua in badly infested paddocks, up to eighty per cent. of the vegetation comprised ferns. On this property, some measure of control was obtained by rolling. To be

effective this needed to be repeated before the regrowth of ferns had reached more than two feet in height. Several rollings close together were more effective than when they were spread over a longer period.

Other weeds that were a problem were *Cenchrus echinatus, Digitaria insularis, Mimosa invisa, M. pudica, Sida cordifolia, S. rhombifolia, Solanum torvum, Stachytarpheta sp.,* and *Urena lobata.*

## FENCING.

Cost of fencing varied considerably with the type of fence constructed. The average price for a four-strand barbed wire and steel picket fence was $500 per mile. If bush posts cut on the property were used, this fell to $360 per mile.

On one property, high tensile three-stand barbed wire was being used for internal subdivision and the cost of this was $300 per mile.

The cheapest form of fencing was provided by the use of living posts and barbed wire, which was estimated to cost $256 per mile for four-strand boundary fencing and $217 per mile for three-strand internal subdivision. In this system, green stakes of *Erythrina* sp. were planted on the fence line and the wire nailed to the posts. As the posts often failed to strike and subsequently needed to be replaced, this system was regarded as being inefficient on the property where it was used.

## TYPE OF CATTLE.

The most interesting feature of the cattle carried on all these properties was the predominance of Brahman crosses. The average percentage of Brahman blood was 50 per cent. on all properties. The British breed side of the cross was Angus, Red Poll or Shorthorn.

## CONCLUSION.

In the Morobe District, several copra producers succsssfully run cattle on their properties as a dual enterprise. Apart from diversification of production, this system is attractive because of reduced labour costs for control of grass in plantations. It could be considered as a sideline for plantations which have ready access to main centre abattoirs, for sale of livestock for cattle projects, or for replacement of meat in labour rations in remote areas.

## ACKNOWLEDGEMENT.

I should like to acknowledge the help given by the managers and owners of the various properties for making this information available.

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# CONTROL OF CYCAS CIRCINALIS *WITH* TORDON 50-D

G. D. HILL.*


## ABSTRACT.

*The toxic plant* Cycas circinalis *can be eliminated from pastures by cutting off the top of the plant and pouring 2 ml. of Tordon 50-D concentrate into a small hole in the pithy core of the trunk. Cost of chemical is less than one cent per plant.*


## INTRODUCTION.

The cycad *Cycas circinalis* (*Plate* I) is widely distributed in the Territory. It is a serious problem in pastoral areas as ingestion of leaves and seeds causes unco-ordination of the hind quarters of cattle (Anon. 1963).

*Plate* I.—A mature plant of *Cycas circinalis* in native grasslands, upper Ramu Valley.

Grubbing of the plant is expensive and unless all parts of the plant are removed, suckering occurs. Young suckers partially obscured by grass may be more dangerous than the original plants.

A grazier in the Ramu Valley has worked out a quick and effective method of controlling this plant using the herbicide Tordon 50-D.†

## METHOD.

The method allows untrained labour to deal rapidly with large areas of infestation.

The inexpensive equipment required is shown in *Plate* II and consists of a bush knife, an oil can and Tordon 50-D.

*Plate* II.—The equipment required is simple and cheap.

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† Registered trade name, Dow Chemical Company for a mixture of Picloram (4-amino, 3, 4, 6, trichloro-picolinic acid) and 2, 4-D (2, 4-Dichlorophenoxy acetic acid). (Martin 1968).

The top is cut off the plant with a bush knife (*Plate* III). A small hole is then made in the centre of the pithy core of the trunk (*Plate* IV). Into this is poured approximately 2 ml. of Tordon 50-D concentrate from an oil can (*Plate* V).

*Plate* III.—The top crown of leaves is cut off with a bush knife.

*Plate* IV.—A small hole is gouged out of the pithy central core of the trunk with the tip of a bush knife.

The pithy core of the plant rots leaving a hollow shell of leaf stem bases. There is no regrowth of leaves and treatment appears to be equally effective in both the wet and the dry season. The plant shown in *Plate* VI was treated six months prior to the photograph and could be pushed over with very slight pressure.

*Plate* V.—About 2 ml. of Tordon 50-D concentrate is squirted into the hole from the oil can.

*Plate* VI.—Treated plant six months after treatment at the end of the wet season.

The cost of chemicals is small. One imperial gallon is equivalent to 4.545 litres. Therefore a gallon of Tordon would provide enough chemi-

cal to treat about 2,200 plants. Tordon currently costs $19.25 a gallon so the cost of chemical is slightly less than one cent per plant.

On the property concerned, six labourers were able in nine weeks to clear a 1,500 acre paddock which was severely infested with cycads.

## CONCLUSION.

This method of extermination is cheap, simple and rapid, and should be of considerable benefit to graziers who have problems with cycads.

## ACKNOWLEDGEMENT.

I should like to thank Mr. S. Staines of Gusap Downs for allowing me to bring his experience to the general notice of the farming community.

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# *MURINE MANGE DUE TO* MYOCOPTES *MUSCULINUS (ACARINA : LISTROPHORIDAE)* IN LABORATORY MICE IN PAPUA

N. T. TALBOT.*


## ABSTRACT.

*Murine mange due to* M. musculinus *was recorded from laboratory mice in Papua and New Guinea for the first time. A considerable difference in pathogenicity was reported between two unrelated strains of mice. The condition was controlled by treatment of all animals with* .02 *per cent. Tetmosol solution.*


## INTRODUCTION.

Skin mange in laboratory mouse colonies is not uncommon and has been reported in the literature on a number of occasions (Gambles 1952, Cook 1953). The condition is caused by infestation with either of two Listrophorid mites, *Myobia musculi* (Schrank 1781) and *Myocoptes musculinus* (Koch 1844).

This paper reports two separate outbreaks of myocoptic mange observed recently at the Veterinary Laboratory, Kila Kila, Port Moresby : two strains of mice were involved. The initial outbreak occurred in laboratory white mice maintained at Kila without introductions for the past ten years. More recently however, myocoptic mange was diagnosed in a newly imported brown strain (C38), originating from the Herston Medical School Colony, Brisbane.

To date, mange due to *Myobia musculi* has not been recorded at Kila Kila. This latter parasite is responsible for a more pathogenic skin condition resulting in scab formation and marked pruritis.

It is considered normal for small mammals to carry Listrophorid mites on their fur, however it would appear that these infestations assume pathogenic proportions under certain adverse physiological conditions, such as advanced age in both sexes and lactation in the female.

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## HISTORY.

Parasitic mange has never previously been recorded from the colony at Kila Kila, which, up until August, 1967, was housed in a non air-conditioned building. Over the past two years all experimental animals at the Veterniary Laboratory have been accommodated in colony rooms with a constant air temperature of approximately 70 degrees F.

Unfortunately these new buildings are poorly proofed against entry by wild rodents and a continual trapping programme is necessary to reduce the numbers of these animals.

A simultaneous infestation of the laboratory guinea pigs with the tropical rat mite, *Ornithonyssus bacoti* (Hirst 1913) would suggest that the wild rodents acted as a reservoir of infection for the experimental colonies.

The C38 strain of mice were found to be heavily infested approximately four weeks after introduction to the laboratory. These animals were housed in a separate room and there was no contact with the previously infested Kila strain. It would appear that these animals carried the parasite when introduced from Australia, or that transmission of *M. musculinus* occurred by agent of contaminated feed cubes.

## DIAGNOSIS.

When first seen, the alopoecia was attributed to ascorbic acid deficiency ; this has been common in the past due to the lack of green feed supplementation available locally. An increase

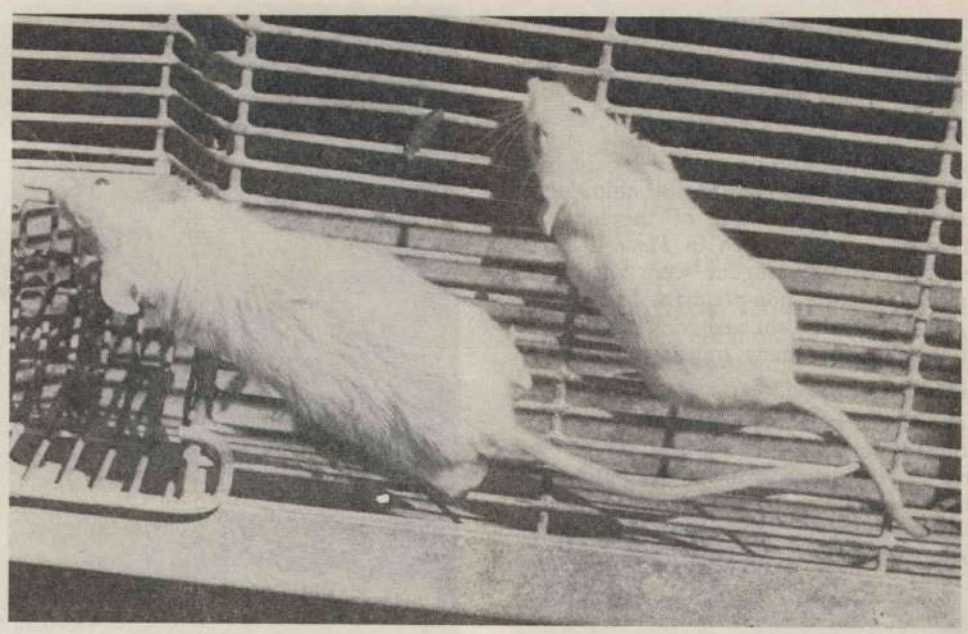

*Plate* I.—*Kila Strain.* The coat of the female on the left shows evidence of a parasite infestation while the young male animal has a normal appearance.

in the amount of soluble Vitamin C given in the drinking water however, failed to relieve the disease.

Diagnosis of infestation with ectoparasites was confirmed by examination of fur clippings under a stereomicroscope.

Identification of *M. musculinus* was possible only after clearing hair material in a five per cent. Potassium Hydroxide solution ; all stages of the life cycle were observed. Examination of the fur of apparently non-affected animals showed the parasite to be present in large numbers.

## MORPHOLOGY AND LIFE CYCLE.

The accompanying photomicrographs are included to demonstrate the general morphology of *M. musculinus* (*Plates* III and IV).

These mites spend their entire life cycle on the hair of the host rather than on the skin and may be found on all parts of the body. The eggs measure 200m. x 50m. and are attached to the hair shaft.

A six-legged larva emerges from the egg and after feeding for a time, moults to produce the eight-legged proto nymph ; a further moult gives rise to the pre-adult stage or deutonymph which moults to the sexually mature adult stages. All stages of the life cycle feed at the base of the hair. The adult mites are easily differentiated morphologically by their difference in size and the shape of the posterior abdominal segments.

### *Female.*

The adult female grows to approximately .3 mm. in length. Legs I and II are relatively small and terminate in short stalked flap-like pretarsi, while legs III and IV are highly modified into hair clasping organs (*Plate III*). The female mite possesses a more elongate body than the male with abdominal cross striations carrying spines.

### *Male.*

The most striking differences in the male are the shorter bilobed posterior abdomen with the presence of small adanal suckers. Leg III is again modified for clasping hair while leg IV is greatly enlarged and ends in sucker-like and claw-like projections.

## CLINICAL PICTURE.

In the present outbreaks, each strain of mice demonstrated a different clinical picture.

*Kila strain.*

These animals showed no marked loss of body hair although there was considerable thinning of the coat. The coarse nature of the hair and lack of lustre is readily seen in *Plate* I. Only lactating females and progeny were affected by the parasite. Mature non-pregnant females and young male animals showed no evidence of infestation although many mites were present.

*C38 Herston strain.*

All animals of both sexes showed evidence of infestation with *M. musculinus*. There was extensive loss of hair on the body, particularly in lactating females. In most animals of this strain there was complete alopoecia along the backline (*Plate* II).

*Plate* II (*a*).—C38 *Strain.* These animals showed an increasing reaction to infestation with *M. musculinus*.

*Plate* II (*b*).—C38 *Strain.* Female one week after dipping in .02 per cent. Tetmosol solution. Note dark appearance of hair regrowth on back

The mite has been observed to feed at the base of the hair by pushing its feeding apparatus (gnathosoma) down into the follicle beside the hair root and feeding on the soft tissues (Hughes 1959). This causes considerable irritation at the skin surface which results in mechanical loss of hair.

## CONTROL.

A number of acaracides have been recommended in the literature for control of mite infestations in laboratory mouse colonies ; these have been summarized as follows (Porter and Lane Peter 1962) :—

(*a*) Benzene hexachloride ;
(*b*) Tetraethylthiuram monosulphide ;*
(*c*) Aramite 15W ; and
(*d*) D M C (Methylcarbinol).**

* Imperial Chemical Industries.
** Neugatuck Chemical Company, U.S.A.

*Plate* III.—Female of *M. musculinus*. Legs 3 and 4 are adapted for clasping of hair.

While BHC has been used successfully in the past, it is the least desirable due to the rapid build-up of resistance to this chemical by arthropod parasites. The product is not recommended for use in young animals due to its toxicity, and unless complete treatment of the colony is carried out, reinfestation readily occurs.

Methylcarbinol has proven most effective as a miticide and may be used in eradication of *M. musculinus* from mouse colonies (Stoner and Hale 1953).

Tetmosol (tetraethylthuriam monosulphide) was used to control the infestations at Kila. This product is used extensively to control sarcoptic mange in man and animals and is relatively non-toxic and easily applied.

A 25 per cent. alcoholic solution of Tetmosol is diluted 1 : 14 in water and each animal is totally immersed in the solution to ensure complete body coverage. The eggs of the mite are resistant to chemical control and a second application is necessary at least two weeks later.

Reinfestation of the animals occurs easily, and an essential factor in control lies in disposal of waste feed and litter as well as heat sterilization of the cages and utensils.

## DISCUSSION.

The observations recorded here are basically in agreement with those of Cook (1953). In the Kila strain, loss of hair was restricted to breeding females and their unweaned litters; although the other animals were observed to carry heavy infestations of *Myocoptes musculinus* they remained clinically unaffected.

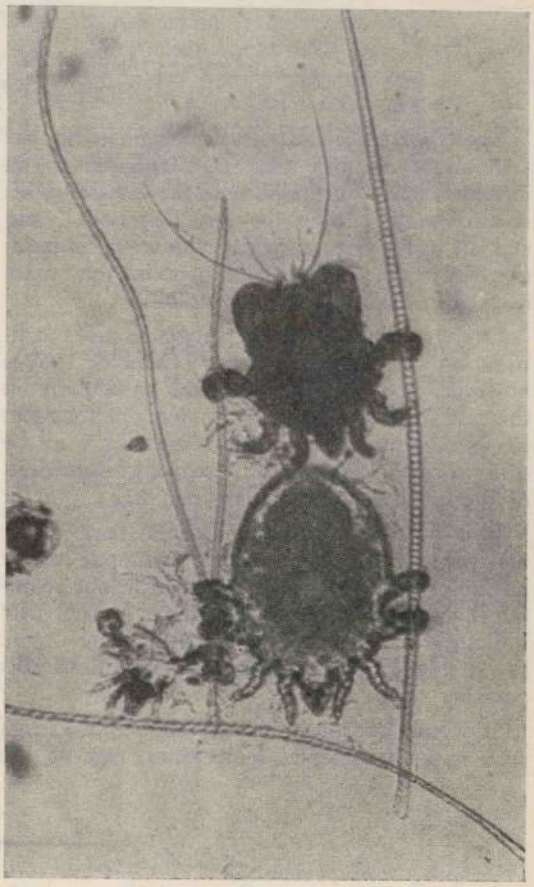

***Plate* IV.—Adult male and female of *M. musculinus*.**

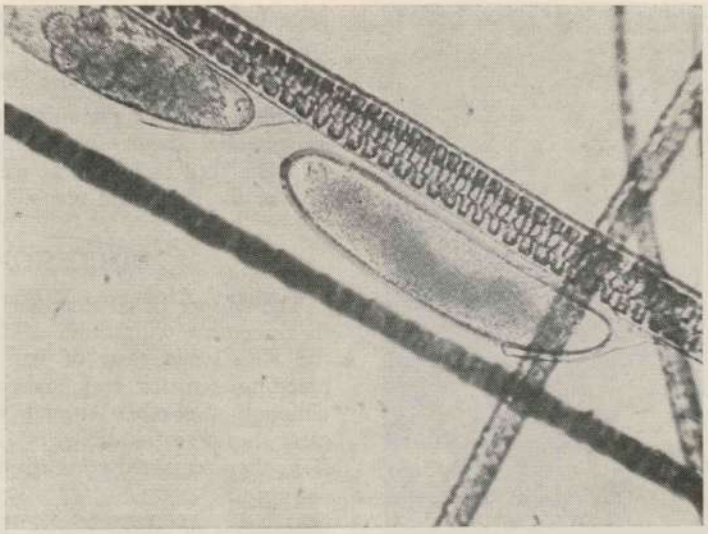

*Plate* V.—Eggs of *M. musculinus* attached to hair shaft.

The apparent increased pathogenicity in the C38 strain of mice may be attributed to an increased strain susceptibility to the disease. This is also borne out by the fact that both sexes, and all age groups showed evidence of infestation in these animals. Alopoecia was more marked in male mice of this strain.

Overcrowding has been suggested as a contributing cause of the disease (Gambles 1952), however, in our experience and particularly in the case of the C38 strain this was not found to be so ; the cages (a uniform 12 in. by 6 in. by 6 in. in size), all carried infested mice regardless of the number of individuals per cage.

It is possible that environmental temperature may play a role. The fact that myocoptic mange has never previously been recorded in our colonies, housed in non air-conditioned rooms may indicate that cooler temperatures are more favourable to the existence and spread of this parasite.

It would appear however, that while factors such as environmental temperature, sex of the individual and housing hygiene may contribute to ectoparasitic infestations of mouse colonies, that a considerable strain difference exists in host animals ; this fact is more likely to account for the conflicting observations reported in previous outbreaks.

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