Pasture Research at Aiyura

With the great increase in the cattle population of Papua New Guinea, a greater knowledge of suitable pastures is required. Pasture grasses and legumes have been imported from several countries, particularly Africa, and work is now being done at the Highlands Agricultural Experiment Station at Aiyura to determine which species are best suited for beef production.

ONE aspect of this work which has attracted considerable attention has been the comparison of productivity of grass species in association with legume species.

The two grasses which have shown up best are Para grass (*Brachiaria mutica*) and *Setaria anceps*. Three cultivars of *Setaria anceps* have been studied in detail; these are Kazungula, Nandi and Aiyura.

The legumes which have shown the best performance include *Vigna oligosperma, Desmodium intortum* (Greenleaf) and *Desmodium uncinatum* (Silverleaf).

1. GRASS SPECIES ALONE

One of the first trials carried out at Aiyura compared the dry matter production of 20 different grasses (without legume) on fertilized and unfertilized plots, also taking into account the effect of grazing on the growth of the various species. The grass was harvested every 6 to 12 weeks, and after each harvest the plots were heavily grazed for a short period, then trimmed to a height of 6 in with a slasher. Fertilizer rates per acre per year were 200 lb N as urea, 50 lb P_2O_5 as superphosphate, 25 lb K_2O as muriate of potash and 1 cwt magnesium—minor element mixture.

The species tested were—

Common Name	Botanical Name
Para	*Brachiaria mutica*
Ruzi	*Brachiaria ruziziensis*
Tarewinnabar (Buffel)	*Cenchrus ciliaris* cv. Tarewinnabar
Nunbank Buffel	*Cenchrus ciliaris* cv. Nunbank
Rhodes	*Chloris gayana* cv. Tanganyika Giant
Pangola	*Digitaria decumbens*
Smutsi	*Digitaria smutsii* cv. Notham
Hyparrhenia	*Hyparrhenia* sp.
Bambatsi	*Panicum coloratum* cv. Bambatsi
Makarikari	*Panicum coloratum* cv. Makarikari
Guinea	*Panicum maximum* cv. Guinea
Coloniao	*Panicum maximum* cv. Coloniao
Hamil	*Panicum maximum* cv. Hamil
Scrobic	*Paspalum commersonii*
Kikuyu	*Pennisetum clandestinum*
Elephant	*Pennisetum purpureum*
Rhonpha	*Phalaris tuberosa* x *Phalaris arundinacea*
Aiyura	*Setaria anceps* cv. Aiyura
Kazungula	*Setaria anceps* cv. Kazungula
Nandi	*Setaria anceps* cv. Nandi
Kabulabula	*Panicum coloratum* cv. Kabulabula

Note.—The Nandi and Kazungula cultivars of *Setaria anceps* were formerly identified as *Setaria sphacelata.*

The trial was laid down on two sites—one on a valley floor and one on a hillside site. The trial was continued until six harvests had been taken.

At each harvest the yield of grass of a small area for each species was weighed and the weight recorded. From these figures the yield in thousands of lbs per acre per year was calculated for each species. These results are given

below with the species arranged in order of decreasing yield. *Table* 1 gives the results for the grass grown on the valley floor and *Table* 2 gives the hillside results.

The results showed a major response to fertilizer after the first harvest, although there was a considerable amount of variation within the plots receiving the same treatment. In later harvests, there was less response to the differences in fertilizer application.

The ten highest species (ranked in order of yield) gave consistent results throughout the duration of the trial.

Tarewinnabar cultivar of Buffel grass showed extreme seasonal variation; during dry periods the growth was very poor.

Hyparrhenia, although ranking high in dry matter production, is not recommended because it tends to become rank, with a subsequent drop in digestibility and protein content.

Hamil and Makarikari showed susceptibility to overgrazing and would be of use only in a rotational grazing regime.

The species which showed most promise for general use were the three cultivars of *Setaria anceps* (Aiyura, Nandi and Kazungula), Para grass and Rhodes grass.

Table 1.—Production of grass on valley floor soils (lb per acre per year)

Fertilized		Unfertilized	
Elephant	27,000	Hyparrhenia	24,000
Aiyura	26,000	Nandi	23,000
Para	26,000	Para	22,000
Hyparrhenia	25,000	Hamil	21,000
Nandi	25,000	Aiyura	21,000
Kazungula	23,000	Kazungula	20,000
Makarikari	23,000	Rhodes	19,000
Hamil	22,000	Rhonpha	19,000
Rhodes	22,000	Makarikari	18,000
Tarewinnabar	22,000	Scrobic	17,000
Scrobic	21,000	Bambatsi	16,000
Rhonpha	20,000	Elephant	14,000
Bambatsi	19,000	Coloniao	14,000
Coloniao	18,000	Smutsi	11,000
Guinea	16,000	Guinea	11,000
Ruzi	16,000	Tarewinnabar	11,000
Nunbank	14,000	Nunbank	9,000
Kikuyu	14,000	Ruzi	8,000
Smutsi	13,000	Pangola	7,000
Pangola	12,000	Kikuyu	6,000

2. GRASS AND LEGUME MIXED PASTURES

Another trial laid down at Aiyura on valley floor soils compared the productivity of fifteen different legumes, each planted in association with the same grass—the Nandi cultivar of *Setaria anceps*. The legumes were all inoculated with Rhizobium.

Plots were allowed to become well established before grazing commenced. Each plot was sampled, then grazed, then slashed back to uniform height. The plots were fertilized initially at the rate of 4 cwt of superphosphate per acre, 2 cwt of potassium sulphate per acre and 1 cwt of mixed minors per acre, with a yearly top dressing of potash and phosphate.

The sampling involved making a complete harvest of a certain area of each plot, separating the legume from the grass, drying each component and weighing each separately. From the dry weight figures obtained, the harvest for the whole plot was calculated. Further calculations were made to give an average figure for 11 harvests of the production rate in terms of pounds per acre per year.

Results

The yield of grass and legume (dry matter production) expressed in lb per acre per year is given in *Table* 3.

Table 2.—Production of grass on hillside (lb per acre per year)

Fertilized		Unfertilized	
Kabulabula	27,000	Hyparrhenia	17,000
Kazungula	26,000	Kabulabula	17,000
Nandi	24,000	Aiyura	16,000
Para	23,000	Kazungula	16,000
Aiyura	23,000	Rhodes	16,000
Coloniao	23,000	Para	16,000
Hyparrhenia	21,000	Rhonpha	15,000
Rhodes	21,000	Coloniao	15,000
Elephant	21,000	Elephant	15,000
Hamil	20,000	Nandi	15,000
Tarewinnabar	16,000	Hamil	14,000
Guinea	16,000	Makarikari	12,000
Rhonpha	16,000	Guinea	12,000
Kikuyu	16,000	Bambatsi	10,000
Makarikari	14,000	Smutsi	9,000
Smutsi	13,000	Ruzi	8,000
Nunbank	13,000	Tarewinnabar	7,000
Bambatsi	12,000	Kikuyu	6,000
Ruzi	12,000	Nunbank	6,000

Table 3.—Legume and grass dry matter production expressed in lb per acre per year

Common Name	Botanical Name	Legume	Grass	Total
	Vigna oligosperma	5,400	16,000	21,400
Silverleaf	*Desmodium uncinatum*	4,800	17,000	21,800
Greenleaf	*Desmodium intortum*	3,700	13,000	16,700
Cooper Glycine	*Glycine wightii* cv. Cooper	3,300	15,000	18,300
	Trifolium rupellianum	3,200	15,000	18,200
	Clitoria rubiginosa	3,100	15,000	18,100
Tinaroo Glycine	*Glycine wightii* cv. Tinaroo	3,000	14,000	17,000
Siratro	*Phaseolus atropurpureus*	2,800	16,000	18,800
Stylo	*Stylosanthes guyanensis*	2,600	13,000	15,600
Calopo	*Calopogonium mucunoides*	1,700	15,000	16,700
Centro	*Centrosema pubescens*	1,600	15,000	16,600
Phasey Bean	*Phaseolus lathyroides*	1,400	20,000	21,400
Clarence Glycine	*Glycine wightii* cv. Clarence	1,100	15,000	16,100
	Dolichos uniflorus	900	14,000	14,900
Townsville Stylo	*Stylosanthes humilis*	600	13,000	13,600

N.B.—*Glycine wightii* was formerly known as *Glycine javanica. Stylosanthes guyanensis* was formerly known as *Stylosanthes gracilis.* Townsville Stylo was previously known as Townsville lucerne. *Dolichos uniflorus* was previously known as *Dolichos biflorus.*

Plate 1.—Aiyura cultivar of *Setaria anceps*

After 11 harvests (extending over 23 months) it was evident that *Vigna oligosperma* gave the highest yield of legume dry matter, and the Nandi grass growing with it also gave high yields, although not the very highest. *Vigna oligosperma* also gave good results in terms of percentage ground cover, vigour of growth, colour and encroachment on other species. Its chief drawback seems to be that it does not produce much seed, which makes propagation a problem.

The two *Desmodium* species gave good results with little to choose between them. There were no great differences between performances of Cooper and Tinaroo glycine, *Clitoria rubiginosa, Trifolium rupellianum,* stylo and Siratro, but the remaining species gave low yields. Stylo does not grow well on heavy soils and is susceptible to overshading.

The order of preference by the cattle appeared to be Silverleaf, Greenleaf, Tinaroo glycine, Clarence glycine, *Vigna oligosperma* and Siratro.

A similar trial was established on a hillside site, but owing to difficulties in establishment, results are not comparable.

3. SETARIA/LEGUME GRAZING TRIAL

In the two previous trials described, the value of the pasture was measured by the amount of grass produced per acre. In this trial, the value of the pasture was measured by the gain in weight of the cattle grazing on it. Three different cultivars of *Setaria anceps* were grown, each with the same legume (equal

proportions of Greenleaf and Silverleaf *Desmodium*). Nine plots, each of one acre, were laid down as shown in the diagram—

Plot 1 Kazungula	Plot 2 Aiyura	Plot 3 Nandi
Plot 4 Nandi	Plot 5 Kazungula	Plot 6 Aiyura
Plot 7 Aiyura	Plot 8 Nandi	Plot 9 Kazungula

Each area was planted first with a 50/50 mixture of Greenleaf and Silverleaf (*Desmodium intortum* and *Desmodium uncinatum*) at the rate of 2 lb/acre.

Plate II.—Silverleaf Desmodium (*Desmodium uncinatum*) in a mixed pasture

One of the three cultivars of *Setaria anceps*, Aiyura, Nandi and Kazungula was then planted in each plot at the rate of 2 lb/acre. Thus, plots 1, 5 and 9 were planted to Kazungula and legume, plots 2, 6 and 7 to Aiyura and legume, and the remaining plots to Nandi and legume.

After 10 months the pastures were well established and grazing commenced.

Nine beasts were used in the trial. They were all $\frac{3}{8}$ Brahman cross steers initially of 500 to 700 lb live weight. Three beasts grazed only on Nandi pasture, another three on Kazungula and the others only on Aiyura. Every three weeks they were moved on to a different plot of the same pasture. At each move the cattle were fasted for 24 hours then weighed and all the weights were recorded. The pasture in each plot was sampled before and after grazing.

At each sampling a small area of the plot was cut and all the pasture was collected and separated into grass and legume, dried and weighed. An estimate was then calculated of the pasture content of the whole plot.

Beasts were replaced when they reached 1,000 lb live weight as their rate of gain from this weight onwards is not the same measure of the productivity of the pasture as it is from 500 to 1,000 lb. At the time of replacement, when the grass was eaten down, the pasture was fertilized at the rate of 1 cwt of superphosphate per acre.

Results

Figures 1 and 2 show the average weight gains for the cattle on each pasture species. There was little difference in performance on the three strains of Setaria, although Kazungula gave lower weight gains in the second period of recording.

Average weight gains per day for the two periods were—

	Period 1	Period 2
	lbs	lbs
Nandi	0.98	0.72
Kazungula	0.97	0.53
Aiyura	1.03	0.70

Weight gains by the $\frac{3}{8}$ Brahman steers were higher than gains of the British breed steers used in Period 2. There were no marked seasonal effects on the rate of growth of the cattle.

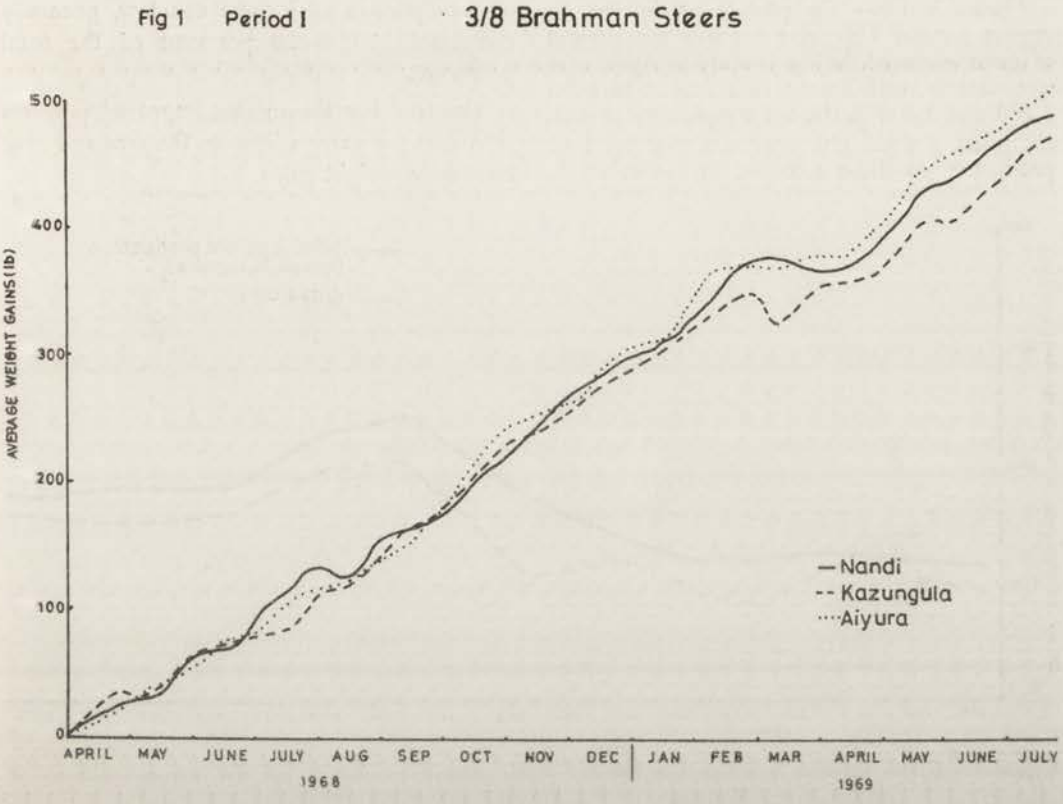

Figure 1.—Graph showing the average weight gain of the ⅜ Brahman steers during the first period of the trial

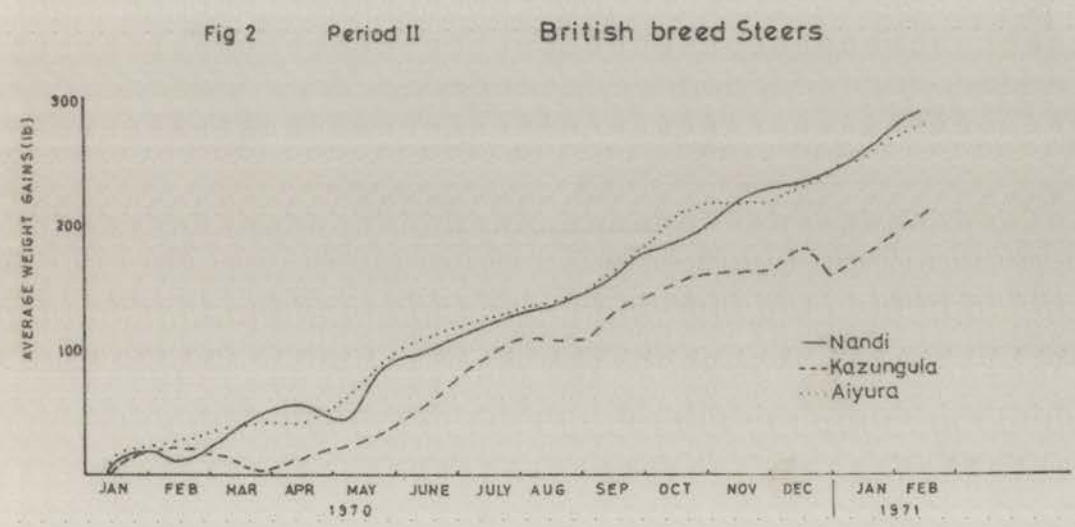

Figure 2.—Graph showing the average weight gain of the British breed steers during the second period of the trial

Figure 3 shows the pasture production on Aiyura *Setaria*. This indicates that the growth of grass increased during January to April (the wet season), with figures estimated at between 1,200 and 2,400 lb dry matter per acre at each recording period. This was a similar level of production to those recorded in earlier trials. The proportion of legume was low, generally comprising 10 to 20 per cent of the total pasturage.

The trial has shown that improved pastures at Aiyura can carry a beast to the acre and give reasonable weight gains.

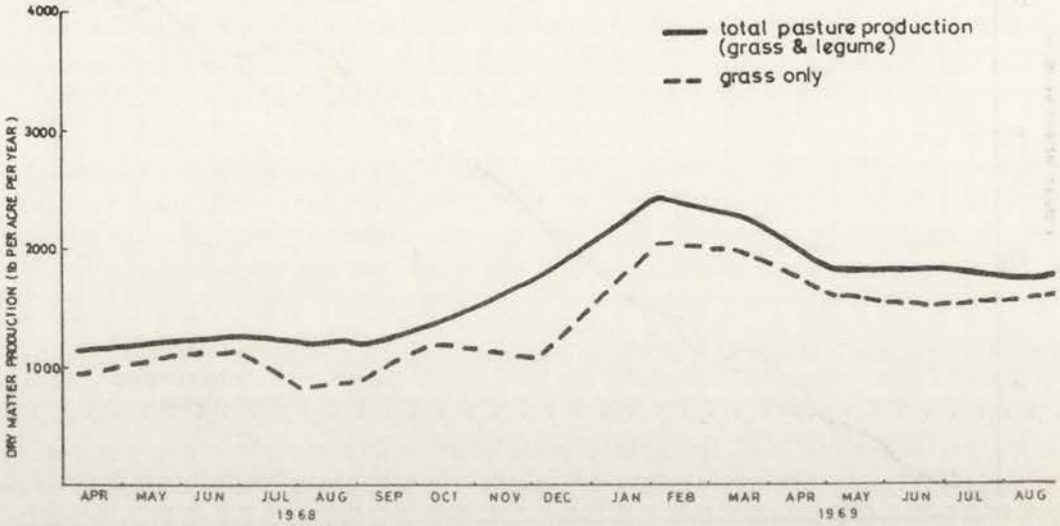

Figure 3.—Graph showing grass production and total pasture production of the Aiyura cultivar of *Setaria anceps* during the first period of the trial