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Effect of supplementing on-farm a diet based on maize, rice bran and cassava chip with Stylo 184 or native grass on feed intake and growth in rabbits

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Abstract

The effect of supplementing a diet based on maize, rice bran and cassava chip with Stylo 184 or natural grasses on feed intake and growth in rabbits was studied in an on-farm experiment. Forty crossbred rabbits, New Zealand White x local breed, 20 males and 20 females, weighing 746 (11.4) g and weaned at 5 weeks of age were used in the experiment. The rabbits were distributed to 5 farmers in two villages, with 8 for each household. The animals were individually caged and randomly allocated to two experimental treatment groups of 4 rabbits each. The groups were balanced for sex, 2 males and 2 females in each group. The treatments were diets containing Stylo 184 or native grass. The farmers were instructed to feed all rabbits the forages fresh *ad libitum* in the amount of 130% of the average forage consumption per day in the previous week and 35 g fresh (~30 g dry matter (DM)) per day of the concentrate.

There was no difference in concentrate intake but the total DM intake in g/day was lower for the diet with native grasses. Intake in g/kg BW was lower for the diet with Stylo 184 and intake in $g/W^{0.75}$ was not significantly different between diets. CP intakes in g/day or $g/W^{0.75}$ were significantly higher in the group fed Stylo 184. Live weight gain was significantly higher for the rabbits fed Stylo 184, 16.8 g/day compared to 12.2 g/day for the rabbits fed the diet with native grasses, and feed conversion ratio for DM and CP was significantly lower for the Stylo 184 diet.

Keywords: Intake, live weight gain, Stylosanthes, native grass, on-farm

1. Introduction

Rabbits in the tropics are only rarely raised on a large commercial scale in which high-cost inputs such as specifically formulated pellets can be justified. Availability, transport and purchasing costs exclude the economic viability of using these feed sources in most situations. The small backyard rabbitry therefore depends on local resources such as forages and agricultural by-products such as bran, all of which can be collected locally (Muir and Massaete, 1996).

Livestock production is very important for smallholder farmers, especially in remote rural areas. They raise animals not only for livelihood security according to resources, requirements and needs, but also for production maintenance in the future, and the social network which is necessary for survival in the longer term (IIED, 1994). Livestock production increases incomes, such as for saving, labour and consumption. Among economically vulnerable groups, livestock play a significant role in the support of their livelihood and lifestyle (IIED, 1994). At the same time, there are many problems in small scale production. However, there are still some opportunities to improve the system. Most of the techniques for keeping animals in smallholder systems are based on the farmers' own experience, since it is not easy to get access to new technologies for supporting the livestock production activities. How can we offer the techniques and other experiences to the farmers in an efficient and sustainable way?

The vast majority of rabbits are produced under small-scale or backyard systems. With current production systems, rabbits are capable of supplying meat in reasonable quantities with relatively low levels of inputs. Performance levels achieved in developing countries have been discussed by several authors but limited data are only available on medium- and large-scale production of rabbits (more than ten females in tropical developing countries). Rabbit production is practised in almost all developing countries and contributes to family nutrition and economy, through the availability of a source of animal protein, as well as through extra income by sale of animals (Suc, 1996).

With increasing reliance on livestock for livelihood security and capital accumulation, farmers are becoming more concerned about livestock management issues. Most farmers rated disease and feed availability as the major constraints in their livestock systems (Horne, 2003).

Stylo 184 (*Stylosanthes guianensis CIAT 184*) is protein-rich forage available in Lao. Stylo 184 is a short-lived perennial legume (2 to 3 years) that grows into a small shrub with some woody stems. It is adapted to a wide range of soils and climates but is one of the few herbaceous legumes, which will grow well on infertile, acid soils. Unlike earlier varieties of *S. guianensis* (eg. cv. Schofield, Cook and Graham) Stylo 184 has shown good resistance to the fungal disease anthracnose in Southeast Asia. It is usually grown as a cover crop, which is cut every 2 to 3 months. It effectively suppresses weeds and is a good feed supplement for most animals, including

chickens, pigs and fish. Stylo 184 can be fed fresh or dried for hay and leaf meal. It does not tolerate being cut close to the ground since there are few buds on the lower stem for regrowth. This can be improved by making the first cut at 10 to 20 cm to encourage branching close to the ground. Subsequent cuts must be made higher (>25 cm) to ensure good regrowth (Horne and Stür, 1999).

2. Materials and methods

2.1 Location and climate of the study area

The experiment was conducted at two villages near to the site of the Livestock Research Center, about 40 km from Vientiane, Laos. In this location there are two main seasons, dry and rainy. The dry season starts early in November and continues until the end of April. The wet season runs from May to October. Annual rainfall is on average 1600 mm and mean temperature is about 25 ^{o}C. The experiment was carried out during the months September to November 2004.

Characteristic of agricultural production most of farming land is low that is available to cultivate only twice per year. The main incomes are from rice production and partly from the livestock production. Some incomes is from small local businesses and labor by working for other farmers.

The different kinds of animals are kept by the small householder farmers in the village such as rabbits, fishes, chickens, ducks, pigs, goats, cattle and buffaloes. Livestock management and feeding are different ways from each other according to the availability of the farmers

The rabbits are local breed and were raised in small-scale systems. They were fed by forage available around that area. However, they were also fed as extra food such as rice and other stuff as available. The purpose is for incomes and home consumption. Most of farmers kept rabbits are because easy to get they feed and easy to managed spend less time that means who ever in household can be help when they have free time also suitable site for home consumption.

2.2 Experimental feeds

The species of improved forage used in the experiment was Stylo 184, which was compared to native grass. The feeds were collected from existing pastures at the Livestock Research Center. Stylo 184 was harvested stepwise to assure a similar age of 40 to 45 days and development and was fed in fresh form. Fertiliser was applied after each harvest, 80 kg urea/ha and 60 kg phosphate/ha at each occasion. The pasture was divided into 10 plots and each plot provided enough feed for 4 days and was rotated. The feed farmers were manually harvested twice per day, in the morning at 06.00 h and in the afternoon at 15.30 h.

The natural grasses consisted of several different species of grasses e.g farmers collected around the pasture site manually twice per day, in the morning at 6:00 h and in the afternoon at 15.30h.

Rice bran and maize were purchased from the local market and cassava chips were bought from farmers and chopped manually into 2-3 mm pieces then sun dried for 4-5 days and fed in a mixture with rice bran and maize as a basal diet. The basal concentrate diet consisted of 302 g maize, 496 g rice bran, 192 g cassava chip, 4 g salt and 4 g vitamin premix per kg feed.

2.3 Animals and management

The on-farm feeding trial was conducted by farmers. Forty crossbred rabbits, New Zealand White x local breed, 20 males and 20 females, weighing 746 (11.4) g and weaned at 5 weeks of age, were used in the experiment The rabbits were bought from a factory producing vaccines in Nongthang about 8 km from Vientiane. On arrival, the rabbits were given amino vitamin, an anti-stress agent, in drinking water. They were treated against endo-parasites with coopane, a brand of piparazine, at the rate of 2 g per litre of water.

The rabbits were individually caged and fed. The feeding troughs were divided into two sections in order to separate the feedstuffs and water was provided *ad libitum*. The animals were fed twice per day at 7.00h and 16.30h. Farmers made continuous observations to ensure the permanent availability of feed and water.

2.4 Experimental design

The 40 rabbits were distributed to 5 farmers in two villages, with 8 for each household. A complete randomized design was used and the animals were randomly allocated to two experimental treatment groups of 4 rabbits each. The groups were balanced for sex, 2 males and 2 females in each group. The treatments were diets containing Stylo 184 or native grass The farmers were instructed to feed the forages fresh *ad libitum* in the amount of 130% of the average daily forage consumption in the previous week and 35 g fresh (~30 g DM) per day of the basal diet, the same for all rabbits. The control group was fed the basal ration and native grasses. The amount of basal diet to be fed was checked during the adaptation period to fix an appropriate level and was increased when the rabbits were growing.

2.5 Data collection and analysis

The chemical composition of the feeds was determined before the experiment in order to formulate the diets for animals. Samples of feed were then taken by farmers once every week and were pooled to 1 sample per 2 weeks.

The feed consumption was recorded and feed refusals of native grass and Stylo 184 were collected from individual animals and weighed every day in the morning before feeding and then pooled together for each treatment for 2 weeks. To be able to record the feed intake the DM of the fresh feeds offered and the refusals were checked with a microwave oven every day if the variation in humidity was great, otherwise 2 times per week.

The samples were analysed for DM and ash according to standard methods of AOAC (1980). Neutral detergent fibre (NDF) and acid detergent fibre (ADF) were determined by the methods of Van Soest and Robertson (1985). N was analysed by the Kjeldahl method and CP was calculated as Nx6.25. The samples of DM, N, and ash were analysed in the Livestock and Fisheries Department. NDF and ADF were analysed in the Animal Nutrition Research Center, Khon Kaen University, Thailand.

The animals in the experiment farmers were weighed when the experiment started and then once per week before feeding at 7.00 h. The experiment lasted 70 days.

2.6. Statistical analyses

The information from the on-farm feeding trial was coded and analysed with variance analysis using Minitab Software Release 13.31 (Minitab, 2000). The model used was: $Y_{ij} = \mu + A_i + B_j + S_k + e_{ij}$ where Y_{ij} = growth or feed consumption, μ = overall mean, A_i = effect of diet, B_j = effect of farmer, S_k = effect of sex and e_{ijk} = random error.

3. Results

The protein content of the Stylo 184 and native grass was 181 g and 172 g/kg DM, respectively (Table 1). The native grass had a high level of ash. The CP content of the concentrate was 99 g/kg DM. Both forages had moderate levels of ADF.

There was no difference in concentrate intake but the total DM intake in g/day, was lower for the diet with native grasses (Table 2). Intake in g/kg BW was lower for the diet with Stylo 184 and intake in $g/W^{0.75}$ was not significantly different between treatments. CP intakes in g/day or $g/W^{0.75}$ were significantly higher in the group fed Stylo 184.

Live weight gain in g/day (Table 3) was significantly higher in the rabbits fed Stylo 184 and feed conversion ratio for DM and CP was significantly lower. Growth curves for the treatments are shown in Diagram 1.

Table 1. Chemical composition of the feeds (means and SD)

	N	DM g/kg	g / kg DM			
			CP	Ash	NDF	ADF
Maize	3	877 (5.1)	89 (3.9)	10 (5.3)	476 (8.5)	37 (6.0)
Rice bran	3	891 (6.8)	114 (5.7)	56 (4.9)	222 (6.1)	57 (3.1)
Cassava chip	3	872 (7.3)	19 (2.3)	21 (5.2)	191 (5.5)	44 (5.9)
Concentrate	3	871 (1.9)	99 (1.8)	50 (2.4)	362 (5.8)	61 (5.1)
Stylo 184	5	224 (3.9)	181 (1.9)	58 (4.2)	560 (21.5)	374 (14.0)
Native grass	2	198 (1.5)	172 (1.3)	76 (3.7)	490 (26.2)	386 (11.7)

Table 2. Feed intake (least squares means (LS-means) and standard error (SE))

	Diet		
	NT	*ST*	*SE*
Feed intake, g DM/day			
Concentrate	41.5[a]	41.2[a]	0.61
Stylo 184	0	52.3	0.53
Native grass	43.4	0	0.53
DM intake, total, g/day	84.9[a]	93.4[b]	0.73
DM intake (g/kg BW)	82.8[a]	75.7[b]	1.12
DM intake (g/kg $W^{0.75}$)	83.3[a]	79.8[a]	0.95
CP intake (g/d)	11.3[b]	13.9[a]	0.10
CP intake (g/$W^{0.75}$)	11.1[b]	11.9[a]	0.13
CP intake g/kg DM	136.1[b]	151.3[a]	0.75

[a, b] Means within rows with different superscripts differ significantly ($P<0.05$)
NT=native grass; ST=Stylo 184,

Table 3. Initial weight, live weight gain and feed conversion ratio (FCR)

Items	Diet		SE
	NT	ST	
Initial weight, g	732.5[a]	759.5[a]	11.45
Final weight, g	1474.0[b]	1767.0[a]	18.21
Live weight gain (g/day)	12.2[b]	16.8[a]	0.44
FCR-DM (g LWG/g DM)	6.8[a]	5.6[b]	0.18
FCR-CP (g LWG/g CP)	0.9[a]	0.8[b]	0.03

[a, b] Means within rows with different superscripts differ significantly (P<0.05)
NT=native grass; ST=Stylo 184,

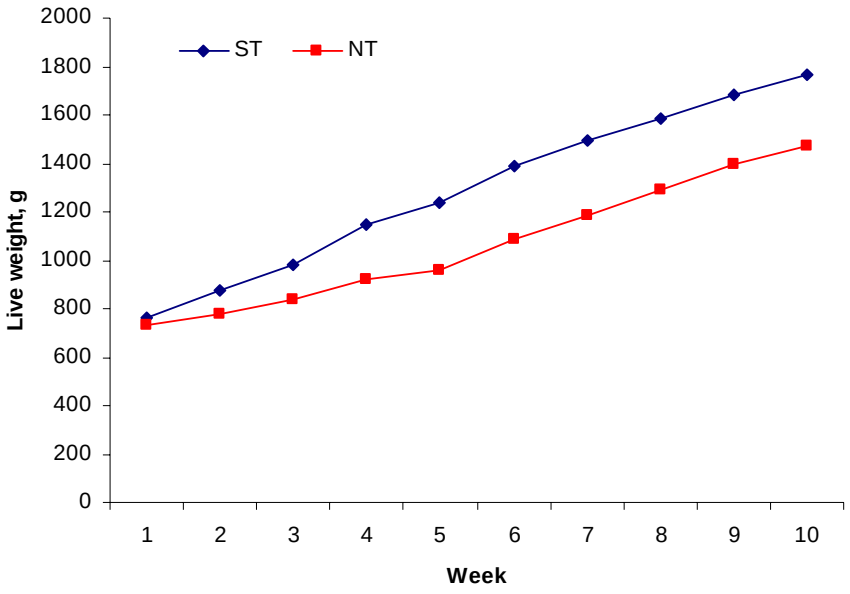

Diagram 1. The effect of feeding Stylosanthes CIAT 184 (ST) and Native grass (NT) on growth performance of rabbits.

4. Economic analysis

Ingredient and diet costs and an economic analysis of the effect of dietary treatment for the experimental are shown in Table 6. Total feed costs for Native grass were 75413 Kip/kg lowest than Stylo 184 was 114693 Kip/kg. However the feed cost/kg weight gain including labor cost the diet of Native grass 6181Kip/kg DM were lowest than the diet of Stylo 184 were 6827 Kip/kg DM for the growing period.

5. Discussion

The nutrient composition of Stylo 184 used in this study is comparable to the values in Paper I but also of values of Bamikole and Ezenwa (1999) and Adegbola et al. (1985).

The CP content and the DM consumption were higher for the Stylo 184 diet than for the native grass diet. Concentrate intake was, however similar between diets. The higher intake of Stylo 184 can be an effect of the higher CP content. There is often a positive correlation between CP content and intake. The intake of CP expressed as g/kg DM was 136 g for the native grass diet and 151 g for for the Stylo 184 diet. According to NRC (1977) rabbits require a minimum of 160 g CP per kg DM. This is however, for temperate conditions.

The rabbits fed Stylo 184 had significantly higher live weight gain and better growth performance than the rabbits fed native grasses. Native grasses in combination with home mixed concentrate may not have provided adequate quantities of CP, CF and minerals to meet the requirements for growth of the rabbits. This could be one possible reason for the slower growth rate of rabbits fed the native grass diet compared to rabbits fed Stylo 184.

All rabbits were fed a basal diet of concentrate. According to De Blas et al. (1981) the value of forage diets is improved when concentrate is added to the diet. These observations were confirmed by Amici and Finzi (1995).

In on-farm feeding trials, which are managed by the farmers, feeds may not be provided on time and in adequate amounts, which may affect the results. High ambient temperatures during the experiment on-farm may also have affected feed intake negatively. McNitt and Lukefahr (1993) reported that temperature and day length had a significant effect on rabbit growth performance.

Table 4. Feed cost, Kip/kg DM

Feed ingredients	Cost, Kip/kg DM
Cassava chip	1122
Rice bran	1137
Maize meal	1856
Native grass	1110
Stylo	1997
Salt	2122
Premix	17010

Table 5. Basal diet cost, Kip/kg DM

Feed ingredients	kg ,DM
Rice bran	50
Maize meal	34
Cassava chip	15
Salt	0.5
Premix	0.5
Cost, Kip DM	1464

Table 6. Economic analysis of dietary treatments (Kip)

	Treatment	
Items	NT	ST
Basal diet	42002	42002
Native grass	33411	0
Stylo	0	72691
Total feed cost	75413	114693
Days	70	70
weight gain, kg	12.2	16.8
Feed cost/kg weight gain	6181	6827

6. Conclusion

Rabbits fed the diet with Stylo 184 had a higher daily gain and a lower feed conversion ratio than the rabbits fed the diet with native grasses. The growth rates were in general low.

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