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LIVESTOCK PRODUCTION UNDER TREE CROPS IN THAILAND

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ABSTRACT : The research and development aimed at livestock production under tree crops in Thailand are reviewed with assessing potentials for the future. There are close to 2.1 million ha of fruit tree and tree crops which at present are seldom utilized for livestock production. Likewise, vast area of forest plantation potentially available for grazing still remains untapped. According to the available data *B. brizantha, B. miliiformis* and *B. ruziziensis* are the promissing grass species in coconut plantation. The evaluation of forage species under rubber and fruit tree plantations given by several authors are also presented. Additionally a preliminary study and observation on grazing under forest plantation are reviewed and discussed.

INTRODUCTION

Livestock production under tree crops is assuming increasing importance in Southeast Asia and the South Pacific. In recent years, many coconut-producing countries have adopted cattle raising in the coconut plantation. In addition, the data from Malaysia suggests that mixed grazing by large and small ruminants in oil palm estates may be beneficial to the tree crops. Livestock production under tree crops can raise farm income through sale of meat or milk, while at the same time reducing weed control cost. Related benefits include increased fertility of the soil *via* the return of dung and urine.

The total area of Thailand is 51,311,500 ha of which 29.0 % is forest land and 40.1 % is farm holdings (Office of Agriculture Economic, 1987). Of the farm holdings, there are about 2,154,165 ha or 10.5 % for fruit tree and tree crops which are seldom utilized for livestock production at present. Likewise, vast area of forest

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plantation which are potentially available for grazing still remain untapped. This report constitutes an effort to review research and development information with regards to the integration of livestock under tree crops in Thailand.

1. Pastures and cattle under coconuts

There are approximately 400,000 ha of coconut farms in Thailand which are mostly located in the south. Cattle and other livestock have been raised on coconut farms for a long time. Probably the main reasons for this practice in the past were (1) to help keeping down weed growth (2) to provide food for cattle and (3) to provide manure for coconuts. However, the majority of plantation owners are not convinced of the benefit of this integrated system, believing that it is harmful to the palms. Pasture under coconuts is still in the early stages of development.

1.1 Natural forage in the plantation

The most common native forage species found under coconuts are sour grass *(Paspalum conjugatum)*, carpet grass *(Axonopus compressus)*, cogon *(Imperata cylindrica), Microstegium ciliatum, Ottochloa nodosus* and *Desmodium ovalifolium.* On the more sandy soils of the eastern coastal areas the most common species are *Chrysopogon orientalis* and *Eremochloa ciliaris* (Manidool, 1984). Suwanarak (1987) mentioned that in the coconut plantations, annual mowing could reduce population of *Imperata cylindrica.* In this case other weeds such as *Echinochoa colonum, Digitaria ascendense* and *Pennisetum* spp. are commonly found. The same author observed that *Axonopus compressus* is exceptionally shade -tolerant. She also reported that dry matter yield of weed in 3-4 year-old and more than 10 -year -old coconut plantations were 24.6 and 11.3 t/ha, respectively. Duryaprapan (1977) found that *Axonopus compressus* and *Paspalum conjugatum* produced green yield of 18 and 19 t/ha respectively, compared with 24 t from *Brachiaria brizantha* when all are grown under the same shady condition in a coconut plantation.

1.2 Selection of adaptable species

Manidool (1984) reported that *B. brizantha, B. miliiformis* and *B. ruziziensis* are promising grass species in coconut plantation. In 1981 *B. ruziziensis* was tested in a private plantation. The test was designed to compare the effect of two seeding rates, 10 and 14 kg/ha and five levels of fertilizer. The results are shown in Table 1. The results showed that a combination of high seeding and high fertilizer rates gave a greater air-dry-yield of grass, with 24.6 t/ha being obtained from a treatment of 14 kg/ha seeding rate combined with 752 kg/ha of the 12-12-24 fertilizer. Boon klinkajorn and Duryaprapan (1976) had conducted an experiment to study the adaptability of *Panicum maximum* cv. Common, *B. brizantha , B. mutica* and

Centrocema pubescens under three different sites of coconut plantation. The three sites had distinct soil types, representing area of a high, medium and fairly low fertility. *P. maximum* cv. Common gave the highest yield at all sites. On high fertility soil, *B. brizantha* gave higher yield than *B. mutica*. On the other hand where the soil was poor in fertility, *B. mutica* performed better than *B. brizantha*. In the case of *Centrocema pubescens* in a mixture with the other three grass species, performed well at all sites with no significant difference in yield. Manidool (1984) mentioned that *Centrocema pubescens* is most suitable under coconuts. This type of legume has long been used for many years as a cover crop in fruit trees and rubber plantation.

1.3 Fertilizer experiment

A fertilizer trial on *P. maximum* cv. Common pasture under coconuts had been conducted by Duryaprapan and Boonklinkajorn (1977). The experimental plots were fertilized with a 15-15-10 compound fertilizer at 4 different rates, 0, 250, 500 and 1,000 kg/ha. Average green yield (moisture 80%) of 4 cuts were 14.2, 25.9, 41.6 and 51.1 for the plot received 0, 250, 500 and 1,000 kg/ha compound fertilizer

Table. 1. Effect of seeding and fertilizer rate on yields of *B. ruziziensis* under coconut (Manidool, 1984).

Fertilizer (12-12-24)	Seed, Rates (kg/ha)			
	10		14	
← kg/ha →	← air dried wt. (t/ha/ year) →			
	1st year*	2nd year*	1st year*	2nd year*
0	7.8	13.3	8.0	13.3
188	7.6	14.4	6.9	12.4
378	7.7	15.8	8.8	16.1
564	11.1	17.7	9.2	16.9
752	6.3	14.8	11.1	24.6

* 2 and 6 cuts for the first and second years, respectively. Average rainfall 200 mm. per year.

respectively. At fertizer level of 500 and 1,000 kg/ha the yield of the grasses were not significantly different, but both treatments were significantly higher than the rest. At the end of the experiment the pH and K content of soil were found to have decreased while organic matter and phosphorus had increased.

Coconut palm are known to require high level of K for normal growth and high production. Also, some species of pasture plants, such as *P. maximum* cv. Common, have a high K requirement. If these grasses are to be included in a pasture-coconut program, adequate amount of K should be applied (Manidool, 1984). Manidool (1984) reported that *B. brizantha, P. maximum* cv. Common and *B. mutica* grown in association with coconuts cause a serious reduction in the magnesium content of the coconut leaves

1.4 Grazing trials

Boonklinkajorn *et al.* (1982) studied on liveweight gain of Thai Indigenous-Brahman crossbreds grazing on signal-centro pasture and native grass-centro pastures under coconuts. The effect of three stocking rates, 1.0, 1.5 and 2.5 beasts/ha were compared. This trial lasted for two years. The result indicated that there was neither a statistical significance in the weight gain of experimental cattle in the first year nor between cattle in the following year under different stocking rate. An evaluation on pasture yield revealed that different grazing pressure employed in this study did not affect forage dry matter yield. However, pasture yield tended to decline in the second year.

2. Forage and livestock under rubber plantations/fruit tree

In 1986 there were approximately 1.9 million ha. of rubber in Thailand and it is roughly estimated that rubber replanting to replace the under-productive plantation is about 48,000 ha. per year (Anon, 1980). In young plantations especially the first 2-3 years , many crops such as upland rice, banana, maize and vegetables as well as forage crop may be planted in a central strip between the rubber rows. However, the interrow area are still under-utilised especially for livestock production. Furthermore, very little information concerning the integrating of ruminant production with rubber plantation is available in Thailand.

2.1 Evaluation of forages species

A range of grass and legume species were evaluated under one-year-old rubber plantation by the rubber research centre in 1980.The forages were interplanted on 5x14 m plot. The soil type was red yellow pedzodic with sandy loam surface and good drainage. Grasses were cut every 45 days and every 90 days for legumes. Green forages yield are shown in Table 2. In this study *B. brizantha,* Napier grass

Table 2. Average forage green yield (t/ha) from 18 months growing period. (Grasses 11 cuts, legume 5 cuts), Anon,1980.

Forage	Average yield t/ha.	Forage	Average yield t/ha.
B. brizantha	129.4	*Pennisetum purpureum*	97.2
B. mutica [1/]	31.5	*Setaria sphacelata cv. Nandi*	61.3
B. ruziziensis	59.2	*Tripsacum Caxum*	67.8
P. maximum cv. Common	80.8	*Centrosema pubescens* [2/]	28.8
P. maximum cv. Hamil	91.4	*Macroptilium atropurpureum cv.Siratro*	12.6
P. maximum cv. trichloglume	41.4	*Pueraria Phaseoloides*	26.3

Note : [1/] From 9 cuts. [2/] From 4 cuts.

(Pennisetum purpureum) and Hamil grass *(Panicum maximum* cv. Hamil) have shown supperior productivity.

2.2 Sheep under rubber plantation

In 1977-78 there was a report concerning with sheep raising in the rubber plantation. This study was conducted in the south by the staff of Rubber Research Station at Yala. Nineteen sheep were allowed to graze on native vegetation under a productive rubber plantation for one year. Concentrate feed and minerals were supplemented sometimes. The major native vegetation which found under the plantation were *Axonopus compressus* and *Ottochloa nodosa*. The others were mentioned such as *Seleria sumatrensis, Paspalum conjugatum, Tetracera scandeus, Desmodium spp.* and self-sown rubber seedling, It was observed that litter size was 1.4 lambs and birth weight of both sex was 1.7 kg. Lambing interval was 227 days for the experimental folck. High mortality of lambs were reported. The major health problems were pneumonia, endoparasites and dog attacking.

2.3 Pasture and fruit tree

Many kinds of fruit tree such as longan and litchi are vulnerale to damage by livestock. The damage from livestock is not only by consumption but more frequently by breakage through rubbing, horning and trampling. The safest policy is to avoid grazing completly. A cut-and-carry feeding system will reduce livestock damage to tree and soil structure but this system causes a great nutrient transfer,

Added input of fertilizer are necessary to prevent the losses of soil fertility. This management practice can be found in the area of Chiang Mai and Lampoon provinces in the north where longan orchard are grown pararel with dairy cattle raising. It is observed that *B. mutica* is preferred to other species. The upright and bunch-type growth habit grasses may cause difficulty in orchard management. The species which compete severely with fruit tree for nutrient may not fit as forage in the orchard.

Manidool (1988) investigated the production of grasses and legumes in 11-year-old sweet tamarine orchard. Four different levels of 15-15-15 combined fertilizer (0, 250, 500, 625 kg/ha) are fertilised for the experimental plots. The high production grasses are *P. maximum* cv. Hamil, *B. mutica* and *B. ruziziensis*. As the level of fertilizer increased both grasses and legumes showed positive response.

3. Pasture, livestock and forest plantation

It was reported that in average 480,000 ha of forests was cut annually in Thailand while reafforested rate was only 5,040 ha per year (Anon, 1988). This information show an alarming situation. According to the 6 th National Economic and Social Development Plan of the country it is aimed that 48,000 ha of reafforestation should be worked out (Anon, 1988). The reafforested areas may help solve the problem of limited grazing area for ruminants. Grazing ruminants in the forest plantation help keeping down weed growth and prevent fire hazard. Sata-pornpang (1978) mentioned that *Imperata cylindrica* which is the most troublesome weed in a new forest plantation could be controlled within two years by grazing. The planting of new forest areas frequently leads to conflict between foresters and villagers who wish to use the area for grazing livestock. This problem would be alleviated if the animals could graze in the plantation forests. In fact the utilization of the forest land for cattle and buffalo grazing has long been practised in the region. Forest deterioration can be prevented by giving people the opportunity to make profitable use of forest land or reafforested area.

3.1 Grasses and legumes under forests

Boonkerd (1986) mentioned a number of forage species found commonly in forests namely, *Microstegium ciliatum, Imperata cylindrica, Heteropogon contortus, Axonopus compressus , Arundinaria pusilla, Ottochloa nodosus , Paspalum conjugatum and Desmodium ovalifolium.* Manidool (1985) had shown list of grasses normally found in a particular condition as presented in Table 3. The grass species which could be introduced into the forest plantation are *P. maximum* cv. Common, *P. maximum cv. Hamil, B. ruziziensis, B. brizantha and B. miliiformis* (Manidool, 1985).

3.2 Grazing under forest plantation

Andrew and Kwaengsopha (1978) studied the effects of grazing and fertilization on growth of Pinus and Eucalyptus species in the north of Thailand. They found that grazing appeared to have cause little damage, especially when cattle were introduced after two years. This suggests that it is possible for the livestock and forestry enterprises to co-exist, at least until the growth of the trees reaches a close canopy. In this experiment a stocking rate of 2 beasts per ha was employed. Ruangratana (1982) concluded that cattle raising under the Eucalyptus plantation in the south Thailand could save weed control cost and fire hazard. In addition, an extra income of US $ 73.7 was received per family. Cheva-Isarakul (1986) reported that there was no apparent difference in the performance between the sheep raised under teak plantation and other flock. Anyhow, during the hot, dry season the limitation of available forage has a strong impact on the sheep performance.

4. Prospects for pasture, livestock under tree crop

The problem of integrating livestock production with tree crop plantation should be looked at from a crop point of view, because it is the main objective of the plantation's owner. At present, information concerning with the impact of forage and grazing on the tree is limited. This information play very important role for farmers to realise this practice. More information is required on native grasses and legumes, their persistency under grazing pressure. It is also very important to know feeding behaviour of large and small ruminants under the system. The need for supplementary feeding especially during the hot, dry season with limited forge should be investigated.

In Thailand the adoption of this integrated farming is seems to be feasible for the south and the north region. About 50% of the area of southern region are occupied by fruit tree and tree crop and the major plantation are rubber, coconut and oil palm. The integration of animal production - tree production has been illustrated by many asian countries. In the north, where important watersheds originate, reafforestation of this region is an important part of the Thai government policy. Since very little information is available at present, intensive research in this field is needed. Integrating ruminant production with forest plantation not only brings extra income to villagers but also conserves the valuable forest land for the country.

Table 3. Natural forage plants found in the forest plantation (Manidool,1985).

Species	Environmental conditions
Arundinaria pusilla	Slightly shaded, light soils, moderate rainfall. Northeast.
Axonopus affinis	Moderately shaded, light to heavy soils, high rainfall.
Chrysopogon orientalis	Slightly shaded, sandy coastal soils, high rainfall. southern area.
Coerhorachis glandulosa	Slightly shaded, light soils, moderate rainfall, Northeast.
Cyrtoccocum	Moderately shaded, light soils, high rainfall.
Desmodium ovalifolium	Densely shaded, light soils, high rainfall, Southern area.
Heteropogon contortus	Slightly shaded, moderate rainfall, light to heavy soils. North and West.
Imperata cylindrica	Slightly shaded, upland soils all over the country.
Microstegium ciliatum	Densely shaded, very high rainfall, light soils, Southern area.
Ottochloa nodusus	Densely shaded, light soils, high rainfall, Southern area.
Oplismenus burmanni	Densely shaded, light soils, high rainfall, Southern and Eastern areas.
Paspalum conjugatum	Slightly shaded, moderately high rainfall, light soils, all over the country.
Rottboellia exaltata	Slightly shaded, light soils, Moderately high rainfall.
Setaria verticelata	Slightly shaded, light to moderately heavy soils, high rainfall.

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