

# New forage developments in Bali, Indonesia: *Arachis pinto* as a cover crop and *Calliandra calothyrsus* for cattle fattening

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*Calliandra Calothyrsus* (*Calliandra*) provides fuel, shade, soil stabilisation, and feed for ruminants in several villages in Bali (Kintamani, Besakih, Petang, Pempatan, Rendang and others). These villages are located in upland areas above 500 m altitude with good rainfall. *Calliandra* was introduced to Bali some time between 1970 and 1975, after the eruption of Mount Agung in 1963. At the beginning, it was introduced for reforestation in areas in the south and west of Mount Agung. *Calliandra* grew very well and spread on sloping lands on the foothills of Mount Agung. At present, *Calliandra* has spread out from the forestry area into the farmers' fields and is planted by farmers, mostly as living fences, for feed for cattle and for firewood.

*Calliandra* can grow on low-fertility soil, grows throughout the year in high rainfall areas and is not attacked by psyllids. For feeding of ruminants, *Calliandra* is used in the cut-and-carry system. It has now spread from the Besakih area (region of Karangasem) to other areas bordering the Besakih village.

Recent research in Australia showed that the digestibility and voluntary feed intake of *Calliandra* was higher for fresh than for dried or wilted material (Palmer et al. 1994). In Bali, the farmers feed *Calliandra* fresh to cattle as soon as it is cut. The taxonomy, botanical description, phenology, and breeding system of *Calliandra* are well covered in the literature (Wiersum and Rika 1992).

*Arachis pinto* cv. Amarillo, known as Kacang Pinto in Bali, was first evaluated in 1988-89 in small plots (2-m x 2-m) at Pulkan village in Bali, as one of the species from 37 legumes and 35 grasses (Rika et al. 1990). Kacang Pinto was one of the species selected from the evaluation, and this was based on its good growth and ability to grow well in shade (about 50-60 % shading). All selected species were evaluated in a larger area at the same site (Pulkan village) under a coconut plantation. Kacang Pinto was found suitable under shade in plantations (50% light) as well as a cover crop (Rika et al. 1994).

Kacang Pinto has also shown high potential as a cover crop in coffee, banana, oil palm, macadamia and hearts of palm (Cruz et al. 1994). It was found capable of controlling weeds and fixing large amounts of nitrogen. In Bali, Kacang Pinto has been used as cover crops under orange plantations at Bangli (about 700 m above sea level). It is presently evaluated in Petang (30 km north of Denpasar, about 600 m above sea level with average rainfall of 3000 mm/year) as forage (in cut-and-carry system with dual purpose as forage and cover crop under cassava). The evaluation aims to observe effect on cattle weight, as well as on cassava growth and tuber production. Smallholder farmers are interested to adopt Kacang Pinto both as a cover crop and as a forage. Kacang Pinto is not only eaten by ruminants but also by pigs and kampung chickens. This adds to its potential for adoption by small farmers.

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## Spread and use of *Calliandra* as forage in Bali

After Mount Agung erupted in 1963, most of the villages around it were swept by lava or covered by sandy material. Since 1970, the forest and the farm land bordering the forest area were replanted by trees and forage. For food purposes, smallholder farmers tried to plant cassava. To plant cassava, they had to dig out the sand first (30-40 cm depth) to find the top soil.

In the forestry area, the government planted *Calliandra* in 1980. The Forestry Department contracted smallholders farmers to look after the plantation trees (mainly *Pinus* trees) which had been planted by government at the border area (just beyond the land belonging to farmers), at the southern and western parts of Mount Agung (mainly around Besakih village). As compensation, the farmers were allowed to plant *Calliandra* and *Pennisetum* grass under *Pinus* trees and to harvest the branches of *Calliandra* and *Pennisetum* grass regularly for forage (seeds of *Calliandra* and planting materials of *Pennisetum* were provided by the government). This system has been successful up to now and has spread to other villages bordering the forest in the other areas in Bali (Bangli, Gianyar, Badung, and Tabanan at 700 – 1,100 m above sea level).

Farmers currently plant *Calliandra* in their land as live fence together with *Pennisetum* grass planted at about 2 m width from the fence. As a live fence *Calliandra* produces about 1.8 - 3 t dry matter per km of fence in 10 months (Wiersum and Rika 1992). The spread of *Calliandra* was through the efforts of farmers themselves, upon learning that *Calliandra* was good forage for cattle.

**Table 1. Production of major tree/shrub legumes used in five areas of Bali.**

Tree/shrub legume	Badung	Tabanan	Gianyar	Bangli	Karangase m
	(Dry Matter yield in tonnes/year)				
<i>Gliricidia</i>	16.3	12.0	1.9	8.5	6.3
<i>Leucaena</i>	1.0	8.3	0.4	2.1	0.4
<i>Calliandra</i>	0.2	7.1	13.9	17.8	1.3
<i>Erythrina</i>	2.3	14.1	2.2	7.8	1.0

Source: Forage Survey in Bali, 1992

Table 1 shows the amount of tree/shrub legumes produced in five areas of Bali. Bangli has the highest production of *Calliandra*, followed by Gianyar and Tabanan. *Calliandra* is the second most popularly used tree forage after *Gliricidia* despite the fact that it was the most recently introduced species.

## Utilisation and benefits of *Calliandra*

*Calliandra* is used both as forage and firewood by farmers. Trees of *Calliandra* planted in 1985 at Besakih were sampled and measured for wood production (Table 2).

**Table 2. Wood production of *Calliandra* at Besakih.**

Yield component	When cut 4 times a year	When cut at the onset of flowering
Tree diameter (cm)	20.5	23.5
Tree height up to branches (m)	2.0	2.5
Fresh weight of young branches and leaves (kg)	5.1	5.9
Fresh weight of branches for fire wood (kg)	0.8	5.5

Farmers cut *Calliandra* 3 – 4 times a year. If more branches are needed for fuel, they wait until *Calliandra* produces flowers. Because of lack of knowledge and extension efforts from the government, legumes are not always used as a source of high-protein feed for cattle. *Calliandra* and *Pennisetum* grasses are only given in the dry season. During the rainy season, when *Pennisetum* and other pioneer grasses grow very well, some farmers use these for feed and *Calliandra* is cut for fuel.

*Calliandra* is eaten by cattle when fed fresh. If wilted, it is not eaten, and the leaflets drop to the ground. In addition to *Calliandra*, *Erythrina* leaves are also fed to cattle and farmers around Besakih boil 2 – 3 kg sweet potato, mix it with water, and give this mixture to cattle every 2 days. In most cases, feed for fattening cattle in Besakih consists of 70-80% *Calliandra* and *Pennisetum*; the remainder being pioneer grass, broadleaf weeds, and sweet potato pulp in drinking water. Farmers who fatten two head of cattle can earn Rp 2,000,000 – 2,500,000 per year from cattle sales. In addition, they can earn about Rp 75,000 per year from manure sales.

Cattle in the Besakih area command a higher price per kg than cattle from other areas in Bali and often win national competitions for best animals (Table 3).

**Table 3. Winners in the 1991 National Cattle Contest (Balinese cattle) at Magelang.**

Rank	Growing Bull	Growing Female	Bull	Male
First prize	Besakih <sup>a</sup> 696 kg	Rendang <sup>a</sup> 260 kg	Pempatan <sup>a</sup> 800 kg	Panasan <sup>a</sup> 410 kg
Second prize	other area from outside Bali	other area from outside Bali	Bangli <sup>a</sup> 647 kg	Blega 449 kg
Third prize	Pempatan <sup>a</sup> (700 m) 650 kg	other area from outside Bali	other area from outside Bali	other area from outside Bali

<sup>a</sup> Villages at foothills of Mount Agung near Besakih.  
Source: The Livestock Services in Bali, 1996.

### *Arachis pinto* a cover crop

After 6 years of research in Bali, Kacang Pinto was identified as having good potential as forage and ground cover. As a result, Kacang Pinto has spread to 15-20 villages in northern Denpasar. These villages are located in a relatively dry upland areas, about 600 – 800 m above sea level with annual rainfall about 2,500 – 3,000 mm.

Kacang Pinto has a high degree of shade tolerance (up to 50 % light), and has shown high potential as a cover crop (Rika et al. 1994). It has shown good capacity to control weeds and can fix large amounts of nitrogen. Kacang Pinto has been used as cover crop in orange plantations in demo plot area in Bangli (700 m above sea level). Because of its high degree of shade tolerance, Kacang Pinto finds application not only as a pasture legume in tree plantations but also as a ground cover (cover crop) in plantation (Cook 1992). Release of nutrients (N,P,K and Ca) from the litter of Kacang Pinto is extremely rapid (Thomas, 1994).

As a cover crop Kacang Pinto has been used in coffee, banana, and oil palm. Preliminary research on the crop has indicated its general capacity for weed control, as

well as nematode control in tomato and coffee. Other uses include soil protection, soil improvement and as ornaments in urban areas, (Cruz et al. 1994).

Kacang Pinto therefore has potential to contribute to physical and chemical improvement (as well as protection) of the soil to supply nutrient, and to increase feed availability and organic matter production. Research in Bali, using Kacang Pinto, *Stenotaphrum* grass (cv. Floratam and ex. Vanuatu) as cover crop in cassava, showed that Kacang Pinto on its own did not reduce cassava tuber yield significantly (Table 4). If grown with grasses, cassava tuber yields were affected. On the other hand, forage production was increased.

**Table 4. Production of cassava (tuber and leaves + young stem) and composition and production of cover crop (1<sup>st</sup> and 2<sup>nd</sup> harvest)<sup>1</sup>.**

Treatment	Cassava leaves and young stem yield (DM g/plant)		Tuber yield (DM g/plant)		Botanical composition (%)		Forage Yield (DM t/ha)
	H-1	H-2	H-1	H-2	H-1	H-2	
Control (cassava only)	114	143	505	745	0	0	1.6
Cassava with - K. Pinto - Weeds	108	152	559	681	- 93 7	- 88 12	4.4
Cassava with - K. Pinto - Floratam - Weeds	145	89	617	461	- 78 12 10	- 94 6 0	3.9
Cassava with - K. Pinto - Vanuatu - Weeds	132	73	515	407	- 72 22 6	- 71 26 3	4.2
Cassava with - K. Pinto - Vanuatu - Floratam - Weeds	162	63	482	377	- 47 32 21	- 60 32 8	4.0

<sup>1</sup> 1<sup>st</sup> harvest in 9-months-old cassava (after 1st harvest, cassava is replanted in the same hole). Cover crop was 4 month old. 2<sup>nd</sup> harvest in 10-months-old cassava. Cover crop was 14 month old. Plot size: 5 m x 5 m. Cassava planted at 1 m x 1 m. Forage harvest 3 times in 10 months.

As a cover crop, Kacang Pinto forms very good stolons and also produces a lot of seed in the soil. At Manado and Bali (Surabrata), Kacang Pinto plots were burned in the dry season without any stolons left behind. At the beginning of the rainy season many young seedlings grew from seeds in the soil.

### *Arachis pinto* as forage

In Bali (Pulukan area), Kacang Pinto established in mixtures under coconut plantations, were found to be very resistant to heavy grazing (Rika et al. 1994). In vitro digestibility varied from 60 to 76%, N content ranged from 2.5 to 3 %, and P was in the 0.18 – 0.37% range (Cook 1992). Kacang Pinto (*Arachis pinto*) pasture has resulted in increased live weight gains 20 - 200% and milk yields (17 - 20%) compared with pasture consisting of

grass alone. Highest gains occurred when there was 30% legume in the pasture. Even in heavily grazed pasture and in the dry season, live weight gains are higher in pasture with *A. pinto* than in pasture with grass alone (Cruz et al. 1994).

Annual liveweight gains in pasture with *A. pinto* have ranged from 160 to 200kg/head/year and from 250 to 600 kg/ha depending on the species of the companion grass and the dry season stress existing in the location (Lascano 1994).

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