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# Productive use of livestock wastes; use of goat manure for earthworm production and fertilization of cassava

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## **Goats in the farming system**

Goats are often considered to be "enemies of the environment" as under free grazing systems they can rapidly destroy the vegetation. Some form of confinement, which can be combined with "supervised" grazing in the forest or on waste "scrub-infested" land, is a necessary prerequisite if the goats are to be part of a "sustainable" farming system.



**Photo 1.** Goats are an important component of integrated farming systems



**Photo 2.** The housing system for goats makes it easy to collect the manure

**Photo 3.** Manure is one of the principal products of goat production

## How to use the goat manure in the farming system?

### Housing system

Correct housing for goats implies a raised 'slatted' floor so they have always a dry 'bed'. Goats do not like a damp environment. The raised floor facilitates the recovery of the manure as can be seen in Photo 4.

### Earthworms

When all livestock (especially pigs and poultry) are confined, the earthworms can be raised in heaps of manure on the surface of the ground (Rodriguez 1997). At family level, where scavenging chickens are the norm, the beds must be protected. A hole in the ground about 1\*1 m area and 30 cm deep is one alternative. Once the manure and earthworms are introduced the hole is covered to keep out the chickens. When the process is completed the cover is removed so that the chickens themselves "harvest" the worms



**Photo 4.** Digging the hole

**Photo 5.** A depth of 30 cm is appropriate



**Photo 6.** The hole ready



**Photo 7.** Placing a wooden frame (farmers can use whatever they have available, even the same mixture used for the duckweed ponds)



**Photo 8.** Collecting the manure from underneath the goat pen



**Photo 9.** Carrying the manure to the worm bed



**Photo 10.** Placing the manure in the bed



**Photo 11.** Leveling the manure



**Photo 12.** Inoculating with a mixture of humus and worms



**Photo 13.** The inoculum (normally 1 kg of worms +humus/m<sup>2</sup>)



**Photo 14.** Distributing the inoculum throughout the manure



**Photo 15.** The cover can be made from wood (as in this case) but other available resources can be used



**Photo 16.** The cover is necessary to protect the worms from the scavenging chickens and ducks and birds



**Photo 17.** It is very important to water the worms every day



**Photo 18.** The worms are already processing the goat manure

**Photo 19.** Humus and worms are the products from manure recycled through earthworms

#### Goat manure as fertilizer for "forage" cassava

Goat manure is a convenient "organic" fertilizer for highly productive crops such as cassava. In this case the cassava is grown as a perennial plant for production of foliage. The roots are not harvested. With applications of goat manure of 2 kg/m<sup>2</sup> (20 tonnes/ha) after each harvest, at intervals of 60-70 days, the annual yields of foliage are between 60 and 70 tonnes/ha equivalent to 3 - 4 tonnes of protein.

#### Cassava leaves as feed for poultry and goats

The cyanogenic glucosides in the leaves of cassava, which on ingestion give rise to toxic hydrocyanic acid (Tewe 1991), protect the plant against most predators. When the leaves are destined for use as a protein supplement for pigs and chickens the HCN can be neutralised by ensiling, a process which converts it to the non-toxic thiocyanate. The same occurs in the animal (goat) rumen and provided the rumen is fully functional (usually after 6-8 weeks of age), and the cassava leaves are introduced gradually into the diet, there need be no fear of toxicity. On the contrary, cassava foliage has been shown to be a complete substitute for soya bean meal in cattle fattened with molasses-urea (Ffoulkes and Preston 1978).



**Photo 20.**Collecting the goat manure to fertilize the cassava



**Photo 21.**Fresh goat manure to fertilize cassava



**Photo 22.** With frequent application of goat manure (20 tonnes/ha/harvest), cassava foliage can be harvested at 50-60 day intervals, producing 3-4 tonnes protein/ha/year



**Photo 23.** Separating cassava leaves from the stems. The leaves are chopped and ensiled for pigs and the stems (or the complete foliage) are fed to the goats.



**Photo 24.** Cassava foliage in the feed troughs of the goats



**Photo 25.** Stems and petioles are eaten with equal relish by this mature goat



**Photo 26.** Provided the kids have a functional rumen (usually by 6-8 weeks of age) they can also be fed fresh cassava foliage

**Photo 27.** The kids also enjoy the cassava foliage

Photos by Lylian Rodriguez

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