

APPENDIX 4

FABRICATION METHODS and GUIDE FOR USING MULTINUTRIENT BLOCKS

Because the blocks are essentially used as a supplement during the dry season, it is recommended to start making the blocks when the dry season commences. The air humidity during the rainy season is high and so this period is not convenient for making the multinutrient blocks as the ingredients are hygroscopic. However, it has been found that by incorporating 20 % of clay, this inconvenience is reduced. The block making unit in Cambodia was able to operate normally through the rainy season of 1993 without any difficulty.

1. Making the blocks

Whatever formula is used, the steps for making the blocks remain the same. These consist of weighing, mixing, moulding and drying.

A - Example of the formula developed in Cambodia

1. Formula

<i>Ingredients</i>	<i>(per 100 kg bulk)</i>
Rice bran (or millet or sorghum bran)	35.0
Molasses from sugar cane	20.0
Urea fertilizer (46 N)	7.5
Salt	7.5
Slaked lime	5.0
Cement	5.0
Clay	20.0
Total amount of water (litres)	10

2. Materials

The following materials and equipment will be needed to make about 100 kg of blocks: watering cans, buckets, drums and half drums, shovels, forks, wooden stirring poles, a spring balance, wooden moulds, pounding rods... For small quantities of about 10 kg, the farmer can use much simpler materials as will be shown in the example from Niger.

3. Steps for making up the mixture (100 kg)

The method is the same for making either larger or smaller amounts, as long as the formula mentioned above is respected. For preparing the mix for 100 kg, proceed as follows:

a) Weigh 20 kg of dry **clay** and 5 kg of **lime** and leave them to soak overnight in the required amount of water (10 litres). If the clay is damp, one should reduce the amount of water accordingly. Soaking is done in a half drum.

b) 20 kg of **molasses** are poured into another half drum; gradually add 7.5 kg of **urea** and stir the mixture well with a wooden stick for five to ten minutes. Avoid the urea forming lumps as this could lead to the animal being poisoned. Now gradually add the 7.5 kg of **salt**. This will take longer than the urea to mix in thoroughly with the molasses (a good 15 minutes). Now add in the necessary amount of **cement** (5 kg). This mixes in quite easily.

c) Now this uniform mix of "molasses-salt-urea-cement" is poured into the half drum containing the clay, lime and water. Mix it all together carefully until a uniform paste is obtained.

d) The specified amount of **bran** (35 kg) is placed on the ground in a round heap (**Photo 30**) either on a concrete drying floor or on top of a sheet of plastic. Form a hole in the middle of the heap of bran and gradually add the mix prepared as in (c) above. The bran must now be carefully mixed and blended with the paste using shovels (and/or forks) just as a mason would mix up cement or concrete (**Photo 31**) and until a uniform and coherent paste has been prepared (balls should not disintegrate when modelled in the hands). If the balls do crumble, then one should add a little more water (1 or 2 litres) and continue mixing.

This mixing operation can also be done in a conventional concrete mixer. However the authors have noticed that despite several trials, the paste is never very uniform due to the formation of balls and lumps of bran which are not moist on the inside. Another inconvenience is that quite a considerable amount can remain stuck to the inside of the concrete mixer as it turns, without falling. This problem can be partially overcome by reducing the speed of the mixer. The authors have noted that whether one does the mixing by hand or with a concrete mixer, the time required is about the same (about 45 minutes).

4. Moulding

The mixture which has been prepared is now introduced into the separate moulds. The cubic mould (20 x 20 x 20 cm) consists of four flat pieces of wood (Photos 32, 33 and 34) in which grooves have been made so that they can be easily assembled to form the mould and then later dismantled when the brick is removed. The mixture is strongly compacted in the mould using a heavy wooden or metal pounding rod (Photos 33 and 34). Simpler moulds can also be used such as half buckets, cans cut to size or any other receptacle which is locally available. Taking the bricks out the moulds may be eased if they are lined to start with, using plastic sheet (polythene bags torn open, etc....) which can be used again several times.

5. Removing the blocks from the mould for drying

The blocks are now taken out of the moulds and arranged on a drying floor, preferably in the shade (Photo 35) as the strong sun can cause cracking in the blocks. The blocks will dry and be ready for use after about 10 days. Blocks weighing from 8.5 to 10 kg when dried can be made with this type of mould. The production unit in Cambodia employs 3 workers and produces 800 kg of blocks per day (a 7 hour working day). This simple technique is well adapted both for production on an artisanal scale by the farmer or for more significant production of blocks for resale or for emergency situations. However, the formula requires several different ingredients for which purchase may not be easy in certain regions or the funds available to the farmer may not allow him to buy them all.

B - Example of the formula developed in Niger

This technique which is both simple and of very low cost, was introduced in January 1994 and has now been rapidly adopted by many farmers in Niger. The blocks obtained have good cohesion and are sufficiently hard. They are now starting to be sold on the local market, particularly by women.

1. Formula

<i>Ingredients</i>	<i>(per 100 kg bulk)</i>
Rice bran	65
Urea fertilizer (46 N)	10
Salt	10
Cement	15
Total amount of water (litres)	30 to 50

2. Materials

The materials needed are very simple. The quantities are measured using receptacles which are locally available and which have been calibrated beforehand: calabashes, plastic containers, empty cardboard sugar boxes, tins of conserves, ...

3. Procedure for making up the mixture (10 kg)

The method is the same for making either larger or smaller amounts, as long as the formula mentioned above is respected. For preparing the mix for 10 kg, proceed as follows:

- a) The **bran** (6.5 kg) is carefully mixed with the **cement** (1.5 kg) in a large container.
- b) The **salt** (1 kg) is mixed with the **urea** (1 kg) in another container and a solution made up using 4 to 5 litres of water.
- c) The solution of urea and salt is now gradually sprinkled by hand onto the mixture of bran and cement and carefully kneaded together.

4. Moulding

Once the mixture has been properly kneaded, it is progressively introduced in small amounts into the mould (a tin of conserves) and well packed down by hand (**Photos 36 and 37**).

5. Removing the blocks from the mould for drying

Once the mixture has been well compacted, it is taken out of the mould immediately and dried out in the open for 7 to 10 days in the shade until the blocks are sufficiently hard for transport and resistant when licked (avoid them still being friable as they could then be munched by the animals).

NB when making larger blocks (weighing more than 3 kg) in order to make it easier to remove them from the moulds, dampen the inside walls of the mould first and cover them with a piece of plastic sheet or bag.

If the blocks are not hard enough or are friable, this could be due to:

- errors in the quantities of the ingredients (probably insufficient water)
- insufficient uniformity in preparing the mix,
- insufficient packing down of the mix in the mould,

- a poor quality bonding material: cement which is too old, impurities in the clay (particularly sand),
- poor dissolving of certain ingredients (the urea, salt, lime, ...)

If friability persists despite respect of all these precautions, increase the amount of the bonding agent.

The blocks can be stored in a dry place for several months, even for two or three years. The authors have noticed that the hardness of the blocks increases with storage length. Their chemical composition varies very little.

II. Guide for using multinutrient blocks (SANSOUCY, 1986)

The blocks constitute a **dry season supplement** which can be used until the start of the rainy season. Giving the blocks as a supplement for a ration rich in green forage would be a waste. **They can be given to animals which are being fed forage which has been treated with either ammonia or urea.** However, in this case it is *advisable to suppress completely or reduce the amount of urea in the blocks to a maximum of 5 % to avoid any risk of food poisoning.* This also conforms to the economic interests.

The method of presenting the blocks depends upon the feeding system. **If the animals graze pasture during the day, the blocks may be given in the evening when they return.** In cases where the animals do not go out and remain fenced in (animals being fattened, draft animals, ...) and are fed from the trough, one can leave the blocks available to them throughout the day.

When the stock of multinutrient blocks is limited, it is advisable to distribute them according to a list by order of priority:

- animals which are very weak and which cannot follow the herd,
- draft animals which must be in good condition when the work season commences,
- dairy cows.

And finally one should recall that the blocks contain urea which can be toxic; it is therefore advisable to respect the following precautions:

1. **Only give the blocks to ruminants** (cattle, buffalo, sheep, goats, camels). Only ruminants are able to take advantage of the urea in the blocks, owing to the action of the microbes in their rumen. The blocks should therefore never be given to pigs or equines.

2. **The blocks should be used as a supplement and not as the basic ration.** Multinutrient blocks are "catalytic" supplements which allow the ruminants to take better advantage of poor quality forages but not to replace them. A minimum of coarse forage in the rumen is essential. In consequence, one should never give the blocks to an emaciated animal with an empty belly as one risks causing food poisoning due to an excessive consumption of urea.

3. It is advisable to **respect a transition period** and only to **present the blocks progressively over a period of one or two weeks** so that the microbes in the rumen become adapted to this new supplement which contains urea. The blocks therefore, should not be given to the animals for more than a few hours each day (2 to 4 hours). In case they are refused, it is advisable to put some bran or other appetizing product, on top of the block to help the animal become accustomed to it, such as the farmers do in Cambodia. Once the animals are adapted to the supplement, they will regulate their intake on their own and the blocks can be left available all the time.

The **intake** in the majority of cases where controls have been made with farmers, are approximately as shown below:

- for **adult cattle and buffalo**, from **400 to 800 g/day**;
- for **small ruminants**, sheep and goats, from **100 to 250 g/day**;
- for **camels**, from **300 to 500 g/day**.

In case of indigestion, either slight or severe, it is advisable to check the hardness of the blocks. This can be corrected by modifying the proportion of bonding agent in the formula: add more to increase hardness or reduce it to make the block softer.

4. **Distribution of the blocks should be regular and continuous** so as to avoid having to undergo another adaptation period for the microbial flora in the rumen, which in fact will take another two weeks each time distribution of the blocks is recommenced.