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SMALL SCALE AGRO-INDUSTRY PROJECT

Technical report: Establishment of a small-scale cassava/cornmill for grinding the produce of small-scale farmers

Prepared for the Government of Saint Kitts - Nevis
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Narayan S. Agrawal, expert in milling corn, cassava and other agricultural produce

United Nations Industrial Development Organization
Vienna

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I. General:

Nevis - one time "Queen of the Caribbean" is a sister island to St. Kitts. Both are volcanic islands patterned by fields extending from the seashore to slopes too deep to till. The main cereal of Nevis is corn. The mill is installed at a place known as "Hardtimes" adjacent to a town "Gingerland" surrounded by farming land about 10 km from Charlestown - capital city of Nevis.

In the Agricultural Census year of 1975, St. Kitts - Nevis produced 34,1 thousand pounds of shelled maize, 3.5 thousand pounds of shelled pigeon peas and 16.6 thousand pounds of other peas and beans by 4,524 Agricultural holdings (average holding 2 acres): tillable land in the country is 1,960 hectares; corn is grown as a mixed crop with cotton, but pure stands of maize are also not uncommon. The average yield of corn is 2000 pounds per acre. This does not meet the food requirement of the people and to supplement the need, imports of corn meal, wheat flour and other food items have to be made.

Even the insufficient grain harvest suffers sizeable losses due to insects, rats and moulds at the farm level, during storage. This further depletes meagre resources of food materials as farmers do not have appropriate storage facilities. The following table gives some past information about the food imports in the country (source - Nevis Customs Dept.)

<table>
<thead>
<tr>
<th>Years</th>
<th>Wheat flour</th>
<th>Corn meal</th>
<th>Others</th>
<th>Price US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>9880</td>
<td>Yearly imports varied from 6,000 - 10,000</td>
<td></td>
<td>155,894.71</td>
</tr>
<tr>
<td>1979</td>
<td>12657</td>
<td>Bags of 100 lbs each US$ 30.00 per bag (price)</td>
<td></td>
<td>220,532.36</td>
</tr>
<tr>
<td>1980</td>
<td>11329</td>
<td>Total $180,000 - 300,000</td>
<td></td>
<td>221,430.70</td>
</tr>
<tr>
<td>1981</td>
<td>12163</td>
<td></td>
<td></td>
<td>268,603.42</td>
</tr>
<tr>
<td>1982</td>
<td>12642 (Total)</td>
<td></td>
<td></td>
<td>280,686.01</td>
</tr>
</tbody>
</table>

Total: $1,147,147.20
From the above it is clear that the country is not self-sufficient as far as its food requirements are concerned. However, the Government has embarked upon a very ambitious programme to improve the lots of the small farmers by increasing the agricultural production of the country and specially that of corn which is the staple food crop of the majority of the farming community.

II. Corn Production – Problems and Prospects

Corn being a rain fed crop, the production is dependent upon rainfall. Besides this, other factors limiting the production are (1) lack of handling and storage facilities; (2) milling facilities.

Visits to some farms revealed that the farmers did not harvest the corn crop — dried plants with cobs — were left in the fields because they did not have the facilities to store the cobs/grains: they cannot protect the grain against insect infestation and damage due to storage moulds and rats. The farmers also explained that in the absence of proper milling facilities they cannot make use of the grain as such.

There is no denying the fact, that given the proper facilities for grain handling, storage, quality maintenance, pest control etc., as well as for grinding the corn, the production of corn in the country will increase.

III. Establishment of the Grinding Mill

A hammer mill (English make) Alvan Blanch, Model Essex Major, 3 HP, supplied by UNIDO through UNDP Resident Representative, UNDP Office Barbados, has been installed as mentioned above. It was found on arrival that the motor of the mill got burnt out and had to be sent to St. Kitts for rewinding. Anyway, when the motor was received back, it was realized that the mill can only grind free flowing materials such as grain, peas, beans, etc., but not cassava which is also an important food material which does need grinding into a fine powder before consumption.
Luckily, an old discarded plate mill purchased in the forties was available which has also been put into working condition and properly installed. The mill is made to run with the help of tractor power. The plate mill grinds both corn as well as cassava. Both mills are housed under one roof.

IV. Hammer Mill

1. After continuous run for four hours the motor gets overheated and trips off.
2. It cannot grind on an average more than 50 - 60 lbs per hour of corn - low capacity vis-à-vis the requirements of 150 lbs per hour.
3. If the fine textured corn meal is to be obtained, the grinding capacity goes down to almost two third/half: the customers do require the finest possible texture of the corn meal for their consumption.
4. The blow-away loss is considerable (since corrected through adjustments and repairs).
5. The mill cannot grind cassava, dried pulp of breadfruit etc. - no material other than cereals, legumes etc.
6. Electricity supply being erratic and limited, installation of a high powered mill, say 5 or 7 to 10 HP will not solve the problem of capacity, nor can the mill be used as and when required; it should be possible only when electricity would be available. Use of generator becomes more costly and custom milling charges will have to be enhanced, which farmers would resent.
7. The mill requires more attention and meticulous maintenance: trained people are not available; replacement of worn-out parts may pose a problem: the connecting pipe, cyclone (bin) body etc. are made of sheet metal which may rust very fast (as a matter of fact it has already started at certain points) because of nearness to the seashore.
8. As it is expected that maize (corn) and cassava production would increase progressively over the years, a bigger capacity grinding mill - preferably plate mill of the capacity of 150 lbs/hour powered by a diesel oil engine 7 - 10 HP - would be the most suitable solution to the existing grinding problem of corn/cassava for the next five years.

9. The life of the mill would be considerably shorter as compared to that of the plate mill, keeping in mind the material used for their respective bodies.

V. The Plate Mill

This is an old discarded mill having no source of power to run it. Therefore, every time, a tractor has to be pressed in service as a source of power. The body is made of cast iron and is quite sturdy. Grinding plates are placed vertically and can grind/material (in the present case both maize and cassava); the finesse or otherwise of the texture of the meal can be easily controlled by decreasing/increasing the distance between the two grinding plates by means of a screw-type push in-out lever.

In the existing plate mill, the flutings have worn out: therefore, to obtain the fine textured corn meal, the material has to be passed through the mill 2 to 3 times depending on the moisture content i.e. the drier the grain, the finer the texture. Even then, this mill does about 100 lbs/per hour easily.

The following information which was taken from the corn/cassava grinding records by the Department of Agriculture, Nevis, given an idea of the performance of the Plate Mill, and also how the "milling activity" was phased out and eventually came to a halt in 1982, when a "no mill-no grinding" situation took over which discouraged the farmers from growing more corn.
<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity of corn/cassava (lbs) crushed</th>
<th>Period of time</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>corn 900</td>
<td>cassava 1011</td>
<td>10 days spread over 3 months</td>
</tr>
<tr>
<td>1978</td>
<td>corn 4735</td>
<td>cassava 466</td>
<td>12 days spread over 3 months</td>
</tr>
<tr>
<td>1979</td>
<td>corn 1482</td>
<td>cassava 314</td>
<td>8 days spread over 2 months</td>
</tr>
<tr>
<td>1980</td>
<td>corn 899</td>
<td>cassava 148</td>
<td>4 days spread over 1 month</td>
</tr>
<tr>
<td>1981</td>
<td>corn 2095</td>
<td>cassava 525</td>
<td>6 days spread over 1 and 1/2 months</td>
</tr>
<tr>
<td>1982</td>
<td>No mill-no grinding.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

VI. **Recommendations**

A systematic approach needs to be made to deal with the post harvest problems involved in corn production, including handling, storage, quality control and milling. There are two main constraints viz: storage and milling, which are affecting adversely the production of maize and cassava in the island. The following steps need to be taken on a priority basis.

1. A community storage facility for 50,000 lbs of corn, a mechanical corn sheller and the drying of cassava needs to be provided in the compound of the grinding mill. The land is available and the modus operandi can be worked out once the recommendations are agreed to, in principle by UNIDO. However, a skeleton project proposal is appended herewith which has the approval of the Government.

2. A plate mill to grind 150 - 200 lbs of corn per hour to a fine meal which can pass through a 50 mesh/sq inch sieve needs to be provided.

3. A diesel engine to run the above mentioned mill and sheller - preferably 10 HP - needs to be provided.

4. On-the-job training in storage, pest control, fumigation, milling to be imparted under the proposed project. Farmers, who may store corn in their own houses, need also to be trained in "scientific" storage methods at the farm level under the project.
Suggested UNDP/UNDO Follow-Up Programme

Development of Scientific Storage at National and Farm Levels to Prevent Post Harvest Losses in Grain and Vegetables at St. Kitts/Nevis

Introduction
St. Kitts/Nevis, though earlier known as "Liamira" - The Fertile Island and mostly depending on agriculture, is not self-sufficient in food. The main food crop grown in the country (comprising two islands, mentioned above) is maize followed by cassava - an important root crop. The Government's efforts to increase maize production are dampened in the absence of proper storage and milling facilities for maize, both at the farm and national level. Over the last five years, the production declined from 50,000 lbs to 30,000 lbs, mainly due to these factors. Food imports which the country can ill afford in the form of corn meal and wheat flour is on the increase. Therefore, the Government gives top priority to the proposed project because it would help small farmers to improve their lot as well as lead the country towards self-sufficiency in food.

Aims and objectives
The main objective of the project is to prevent post harvest grain and vegetable losses during handling and storage of these commodities.

A. The immediate or short term objectives
1. Establishment of community bag storage centre for about 50,000 lbs of corn at Hardtimes. The farmers would store maize in their own bags in identifiable individual lots. The centre would provide scientific maintenance of quality during storage by carrying out fumigation and other pest control measures. A few agricultural assistants would be trained to look after this.
2. Establishment of a maize processing centre at the side of the storage centre and this will be equipped with a solar dryer, mechanical sheller and a diesel engine operated grinding mill which would grind cassava also.

B. Long term objectives
1. Establishment and equipping of a post harvest technology course, which would render all assistance to farmers in drying, cleaning, storage, fumigation, pest control and also train Government officials and farmers in improved methods of warehousing management.

2. Establish with the help of the country's Government marketing facilities, procurement and distribution of infrastructure for grain, fruits and vegetables to motivate the farmer to grow more food materials.

3. On the job training of extension workers for about one year and later trainees - training abroad for 3 to 6 months in post harvest technology.

Estimated cost

<table>
<thead>
<tr>
<th>Project No.</th>
<th>UNDP/UNIDO Contribution</th>
<th>Government Contribution</th>
<th>Duration of Project</th>
<th>Commencement of the Project</th>
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<tbody>
<tr>
<td></td>
<td>Approximately US$ 400,000.00</td>
<td>Approximately US$ 159,000.00</td>
<td>3 years</td>
<td>As early as possible</td>
</tr>
</tbody>
</table>
ACKNOWLEDGEMENTS

I gratefully acknowledge the help and guidance so kindly extended by Mr. Sepic - Head, Agro Industries, U.N.I.D.O. Vienna:

Mr. G. Somers - U.N.D.P. Representative - Barbados;

Mr. H. Heyliger - Director Planning Unit;

Mr. E. Hisbett - Ag. Agricultural Superintendent, and,

Mr. E. Halliday - Officer in Charge of Milling Operations


But for the untiring efforts of Mr. Hisbett and Mr. Halliday, it would not have been possible for me to complete this assignment in such a short time.

I should specially thank Mr. S. Daniel, Hon. Minister Nevis Affairs and Mr. J. Parry, Permanent Secretary Nevis Affairs whose personal attention and interest in the project was a source of encouragement.
## ITINERARY OF DR N.S AGRAWAL, UNIDO CONSULTANT

**DELIHI * ST KITTS - NEVIS (PROJECT NO DP/SKT/80/002)**

<table>
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<tr>
<th>Flight</th>
<th>Departure</th>
<th>Time</th>
<th>Arrival</th>
<th>Time</th>
</tr>
</thead>
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<td>Delhi</td>
<td>0855</td>
<td>Rome</td>
<td>1400</td>
</tr>
<tr>
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<td>2050</td>
<td>Vienna</td>
<td>2300</td>
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<td>London</td>
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</tr>
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<td>B'dos</td>
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<tr>
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<td>StKitts</td>
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<td>1600</td>
<td>Nevis</td>
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<tr>
<td>Vienna Air 18383</td>
<td>Vienna</td>
<td>1820</td>
<td>Rome</td>
<td>1955</td>
</tr>
<tr>
<td>Rome Air 28383</td>
<td>Rome</td>
<td>1530</td>
<td>Delhi</td>
<td>0430</td>
</tr>
</tbody>
</table>
Operating and Maintenance Instructions for Essex Major Hammer Mill
Installed at Hardtimes, Nevis West Indies

General
The Essex Major is a high speed with 3 HP, 400 volt, 3 phase, 60 Hz, 3000 RPM hammer mill suitable for grinding free running dry cereals and legumes only; cassava, cotton seed cannot be powdered in this mill. The body of the mill is made of sheet metal. To avoid rusting and corrosion (being near the sea shore), the mill body should be painted at least once a year. The instructions listed below must be meticulously followed to obtain trouble free service from the mill.

Lubrication
Lubrication (as demonstrated to the trainees) should be attended to regularly. The fresh grease in the mill bearings should be filled in the cup (behind the fan) and screwed right down every 500 hours of running. The recommended grease is shell Alvania R3 or equivalent. Through the other two nipples (one under the plastic cover and the other over the body of the motor uncovered on the belt side) grease should be injected regularly.

Operation (As demonstrated and explained below)
1. Before starting the mill it must be ensured that the grinding chamber is empty and the air feed control is closed. Check rotation.
2. When the mill is running, gradually raise the air feed control until full load motor amps are reached; then lock it in position.
3. To obtain optimum feed conditions, the slide on the front side of the feed hopper should also be adjusted by trial and error process. It should then be unnecessary to reset the slide.
4. At the base of the feed inlet, there is a trap chamber for stones, iron bits etc. This should be cleaned regularly by removing the slide.
5. The motor, rotating wheel and belts need to be checked off and on during continuous run of over four hours; if over-heating is observed, the motor should be allowed to cool before starting.

6. The mill is fitted with V belts which are automatically tensioned by the pivoting action of the motor. Therefore, no adjustment is required.

7. The bin (cyclone) and stocking filters should be thoroughly cleaned, rather scrubbed with a long brush, after each milling operation; no deposits of meal be allowed inside as these would allow caking, rusting, development of insects and moulds. The insect infestation once established will be difficult to eradicate from the mill premises. The insect infestation may go to farm houses with corn/ cassava meal powder and this would pose a serious problem in keeping these products in good condition fit for human consumption; even for short periods of time.

8. Only well dried grain (which breaks with a cracking sound under the teeth) should be allowed for grinding; wet grain should be thoroughly dried in the sun before grinding.

9. Unnecessary fiddling with the mill/motor by untrained personnel/ novices, should not be allowed. They may hurt themselves as also the machinery. The motor belt and fan guard should always be kept mounted. *Always* and invariably the mains should be switched off before carrying out any repairs/adjustments or even touching the machine.

10. **Beaters and Screens**
    Out of the three screens provided with the mill, the finest one has been fitted in the mill. However, screen can be changed by removing the mill front after unwinding the two knurled nuts. The beaters can be changed by removing the rotor outer cheek which is held in place by a Kalon Screw. To obtain the best performance from the mill, the beaters and screens should not be allowed to wear too much. The beaters can be reversed and turned end to end to make use of all four corners before finally changing the set. The screens can also be reversed likewise so that they are fully used on both sides.
Spares
The parts which normally would require replacement are the beaters (Kasin No. 76/79), the screens (no Kasin No.) and the fan rotor (Kasin No. 104/23), which can be removed, first removing the fan case at the back of the mill. The spares can be obtained from the following supplier:

M/S The Alvan Blanch Development Co. Ltd.
Chelworth, Malmesbury, Wiltshire, SN16 9SG
England
Tel.: Crudwell (06667) 333/9
Telex: Alvan BC 44304.