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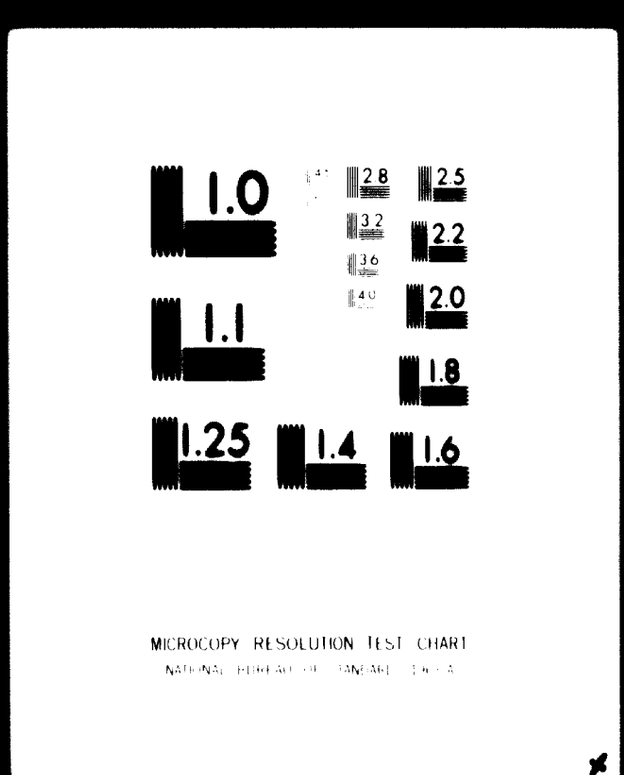

02233

[redacted]

[redacted] Haiti.

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(INCLUDING ESTABLISHMENT OF PILOT DEMONSTRATION MANUFACTURING PLANT, DESIGN AND REPAIR FACILITIES AND DEVELOPMENT OF RURAL INDUSTRIES, PRELIMINARY SURVEY OF RAW SUGAR MANUFACTURE)

081700

[redacted]

(HT/UNI /73/002/ 11-01 / 01 / 10102 /)

TECHNICAL REPORT PREPARED FOR THE GOVERNMENT OF HAITI by -

[redacted]

EXPERT OF THE UNITED [redacted] INDUSTRIAL DEVELOPMENT ORGANIZATION (ACTING AS AN EXECUTIVE AGENCY FOR THE UNITED NATIONS DEVELOPMENT PROGRAMME)

(THIS REPORT HAS NOT BEEN CLEARED WITH THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION WHICH DOES NOT THEREFORE, SHARE THE VIEWS PRESENTED) - TO BE CHECKED AFTER CLEARANCE BY THE UNIDO.

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IV. APPENDICES

SUMMARY OF THE REPORT

1. Project Background. In October 1974 one International Conference called Clinic for Agricultural Machinery and Implements for the least developed countries was held at New Delhi (India) under the programme sponsored by the United Nations Industrial Development Organisation (UNIDO). It was attended by participants from many countries including Haiti (Mr. Fritz Michel, Director,"Groupe Services Agricoles" of the Institute for Development of Agriculture and Industry (IDAI), Port-au-Prince represented Haiti.

2. As a follow-up action for the resolutions passed for the transfer of technology from the developing countries to the least developed countries, the UNIDO suggested a preparatory Mission for 2½ months to work out details for:

a) Establishment of a pilot manufacturing demonstration (with possible finances of US$500,000) including repair, development, training, etc...

b) Being developed further as a second phase for an integrated rural industrial project (with possible finances of US$250,000).

3. The proposal for this type of preparatory Mission was accepted by the Government of Haiti and I arrived in Haiti on 6/1/76. After discussions with the concerned officers of UNDP and IDAI, the work had started with Mr. Fritz Michel as the counterpart and the work was completed on 5/3/76 with the submission of this report.

4. Most of the important agricultural areas in Haiti were visited and the matter was discussed with officers, farmers and firms. The working of some of the existing implements was observed and whatever data was available on the subject was compiled. A quick survey of the existing implements was made and some new designs of implements and tools suitable for Haitian agriculture were also made in prototype forms for trials.

5. As a result of these studies and observations, it is concluded that there is a great scope for introduction of improved implements in Haiti and for starting of rural industries such as making of rapadou, rope making, etc... The details of funds required for the main pilot workshop, drawing up of revised lists of equipment, identifica-

tion of useful implements and their production volume were worked out. Since there is no agency in Haiti to carry out research development and testing of agricultural implements, it has been suggested in this report that a preliminary work on this aspect needs to be done for a period of about six months to design and to test 8 to 10 selected implements, get their dies and prepared fixtures and train the operators. For this purpose an amount of US$50,000 has been suggested. Simultaneously, steps are to be taken for the establishment of pilot manufacturing demonstration workshop costing about US$534,000. For the implementation of the second phase of the project to develop it into an integrated rural industrial activity, the provision required is estimated to be 258,000 US$. The counterpart contribution is estimated to cost US$355,000. Since Haiti is the only least developed country in the Americas and because of its numerous difficulties and handicaps, it is suggested that it may be exempted from this counterpart contribution and as per "Lima Declaration". What is mentioned in this paragraph is the gist of the main recommendation. The other recommendations are given below in summary form in order of their importance.

6. Haiti's farm holdings are very small. Nearly 95% holdings are in the range of 0 to 6.50 Hectares. Manual power is mostly used. Due to the fuel crisis and the level of industrialization in Haiti, it seems that the farmers will have to depend more and more on the use of animal power in agriculture at least for the next 20 to 25 years or more. Therefore, there is urgent need to develop simple bullock drawn implements suitable for Haiti and to take steps to utilize bullock power to the maximum extent by castrating and shoeing the bullocks, etc...

7. First, prototypes of all promising implements should be collected, tested and modified. Lists of such implements have been prepared.

8. On the lines of Group Farms in Uganda, a cooperative project to use modern agricultural machinery may be started at one place in Haiti.

9. Educated entrepreneurs may be encouraged to start Agro-Service Centres and offer custom service to the farmers.

10. Wherever possible, hydraulic rams and wind powered electricity generators may be installed.

11. Simple earth moving tools for agrioulture, rural road making and repairing and for soil erosion control may be used. Steel pans or baskets and Keni or levelling boards are suggested.

12. The designs of implements produced in Haiti may be standardized right from the start in order to maintain quality and for easy interchangeability of parts.

13. Use of domestic fuel is directly connected with serious deforestation and consequent problems of soil erosion. Some ingenious devices to save fuel have been suggested.

14. Sisal is an important crop in Haiti. Its further utilization to manufacture sisal craft (sisal cloth impregnated with coal-tar) for making its use for roofing of houses and grain stores in rural areas has been suggested.

15. Starting of rural industries based on available raw materials such as manufacture of raw sugar, preparation of ropes, drying of mahogany wood, etc... has been suggested.

16. Recommendations have been given for training personnel at various levels, both in overseas countries and for on-the-job training in Haiti.

17. Suggestions have also been made for proper coordination of agrioultural machinery manufacturing faoilities in Haiti and judicious distribution of repair services in the country.

18. It has also been recommended that a new crop Pois chiche (Cicer arietinum) be introduced in Haiti from India. This is a legume which will add to the soil fertility. It is extremely hardy crop and very nutritious in proteins, and it may help some protein problem in Haiti. Small rural industries for its utilization along with raspadore can also be started.

19. Practical work. Opportunity was taken to show how designing implements and their testing can be done. The prototypes of three implements are ready:

a) a maise or rn sheller
b) a manually operated seed-drill and

e) a fruit plucker for mangoes.

Of these, the tool for maize shelling has been tried and looks promising. I have named it as a "HAITIAN" maize sheller, as it was designed by me in Haiti. It is a simple small tool and may cost about 1 to 2 US$ only. A farmer can purchase two to four so that members of his family can use them and do the shelling quickly. The other maize shellers in the market cost US$20 to $450 (Fig. 29 and 30). For very small farms in Haiti, there was need to design a small, simple and cheap maize sheller. The HAITIAN maize sheller fulfills these requirements. The present prototype of this sheller is not perfect. It is only the second one that has been made from scrap, but it shows the principle involved (Rasp action). Later on, I will get it made by using dies and lather straps or will get it made in India from High Density Polythene by injunction methods in one piece. More work on this is therefore necessary. If the preliminary developmental work as proposed in the recommendation No. 1 is partly to be done in India (3 months) and partly in Haiti (3 months), this and other selected implements can be perfected.

In the concluding pages of the main report, appendices have been added, which give the compiled data for ready reference. Sketches have been drawn for easy identification of various types of implements, tools and machines. I take this opportunity for offering my sincere thanks to officers and to the staff of UNDP, IDAI and Outilagri.

Port-au-Prince
Dt. 3/2/76

B.N. Khardekar

B.N. Khardekar
UNIDO Expert in
Agricultural Machinery and
Implements

1 - [redacted]

1.1 [redacted]

THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION (UNIDO) organised an Agricultural Implements and Machinery Clinic for the least developed countries, in collaboration with the Government of INDIA at NEW DELHI from 20th October to 30th October 1974. This was attended by participants from many least developed countries including HAITI, who had deputed Mr. Frits MICHEL of the INSTITUTE FOR THE DEVELOPMENT OF AGRICULTURE AND INDUSTRY (IDAI) to attend [redacted] The Report of this clinic was circulated by the UNIDO to the participating countries with a suggestion to include the draft project circulated with this Report in the country programme and its implementation under the Least Developed Countries (LDC) Special allocation of Indicative Planning Funds and it was also recommended that a preparatory mission of one expert for a period of about two months be undertaken under the UNIDO assistance. The expert will work out the details for establishing an appropriate pilot demonstration plant and elaborate the inputs, finances and work plan.

The Job Description for such an expert is given in APPENDIX - 1

1.1.1 - The Project data sheet for this Preparatory Mission circulated to the participating Governments is given at APPENDIX II.

1.1.2 - The main and general recommendations of the International Agricultural Machinery and Implements Clinic held in NEW DELHI - (20th to 30th October 1974) are given at APPENDIX III for ready reference

.../2

1.1.3 - The proposal for a Preparatory Mission was accept' ed by the Government of HAITI and the UNIDO sanctioned U.S $.10.000.oo for this Project in October 1975 and as a result of this I arrived in Port-au-Prince on 6th January 1976. After discussion with the officers of UNDP, IDAI and others the work was started.

1.1.4 - After the NEW DELHI Clinic's Report was circulated to the participating countries an important development took place at the Second General Conference of the UNIDO held at LIMA (PERU) from 12th to 26th March 1975, and the resolutions passed at the Conference are now well known as the "Lima Declaration" which has emphasised the need for assisting the Least Developed Countries by "Special Measures". The relevant extracts from this Lima Declar' ation have been given in APPENDIX - 4. The Preparatory Mission, therefore, was required to keep these recommendations of the Lima Declaration in view while preparing the Report.

1.1.5 - Before coming over to HAITI I was briefed at the UNIDO Headquarters in VIENNA and was asked to prepare my Report in two phases :

PHASE I - Pilot Demonstration Manufacturing Plant for Agricultural tools, simple implements and hand operated machinery together with Design, Development, Testing, Repair, Maintenance and Training. (Possible Finances U.S. $.900.000.oo).

PHASE II - The above phase I may be expanded into phase II incorporating other metal products and rural industries (the details are given in draft project data sheet on Rural Industrialisation Project at APPENDIX - VI - This includes items such as Steam, Agricultural processing equipment, sugarcane crushers, juice boiling pans, fibre making machines, household, harvest technology, bullock carts, wind mills, pumps utilisation of wood etc...) - The Project to include central advisory services, common technical service possibilities, cooperative marketing facilities etc... (Possible finances U.S. $.250.000.oo).

The details of briefing are given in APPENDIX - V.

.../3

1.1.6 - The two phases of the Project have been prepared within the financial limits mentioned. The costs of equipment and experts have been calculated at current rates but in view of rapid inflationary trends, it is likely that the whole Project will cost anywhere between 15 to [illegible] more, if the implementation starts in the last months of 1976 (October, to December 1976).

1.1.7 - In view of very special conditions in EAFT such as complete import of raw materials such as steel, coke etc... lack of manufacturing facilities particularly for dies, moulds, fixtures and almost complete lack of research on agricultural implements a six month special project has been suggested to obtain important prototypes, dies, raw material for initial manufacture and to demonstrate manufacturing possibilities train the officers and Staff, and carry research development in selected 3 to 4 implements This preliminary phase will form the basis for future work. [illegible], during these months steps are to be taken for placing orders for equipment, recruiting Staff, selection of site and collection of prototypes and construction of Buildings. If the infrastructure had existed in EAFT there was no need for such a preliminary project. Since there is no infrastructure there is urgent need of such a project which has been elaborated in [illegible]. Such a Project will achieve quick results.

[illegible]

2. [redacted]

One medium sized workshop has been established at Port-au-Prince in a joint venture by IDAI and Mr. Raouf Hage, a private industrialist. The workshop is known as 'Outilagri' and manufactures at present only [redacted]. It has sheet metal cutting and forming machines, heat treatment furnaces and some carpentry equipment. The details about this workshop are given in Appendix VIII. It is proposed to utilise whatever machinery and facilities that are available at this workshop and new pilot manufacturing workshop under UNIDO assistance can be erected close to this workshop for better coordination and economy.

3. [redacted]

Extracts are given below from two reports:

A. [redacted]

(Report of the United Nations Mission of Technical Assistance to the Republic of Haiti) - June 1949 - UN Publication - 1949, IIB, 2

3-1
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"The encouragement of rural industries should not be neglected in the preparation of plans for agricultural development. Among such industries are those for processing agricultural produce, such as sugar mills producing 'rapadou' and 'sirop', charcoal kilns of an efficient type lime kilns, coffee hullers, decorticators and driers rice mills, sisal decorticators, oil presses for benseline, [redacted] oil-palm and other sources of edible oil, fish drying and pickling plants, central compost pits and many others. Small wood working plants, to produce furniture, carts, and articles of household use and food preservation plants, as well as storage structure, tobacco curing houses and the like should be provided for in comprehensive planning for agricultural development."

3-2
Page 125

[redacted]

Haiti's need for both industrial and domestic fuel are now met chiefly through wasteful, indiscriminate burning of wood. It is impossible to evaluate in any precise manner, even the approximate amount of wood

that thus goes waste. It is imperative that ruinous practice of charcoal making which is commonly adhered to in the Haitian countryside and which contributes to the appalling deforestation and resulting soil erosion should be changed in harmony with the rational reforestation and conservation policy recommended elsewhere in this report.

There are cheap, simple and efficient methods of converting wood and wood waste into charcoal together with several valuable by-products. In discussing the development of rural industries for production of construction material, we have suggested the combination of charcoal burning with lime production in small integrated units.

3-3
Page 187
(d)
Wind Power

The possibility of converting the energy of prevailing winds into power should be given special consideration. In many countries, wind is utilised by means of inexpensive installations for direct pumping of water or for performing industrial operations which do not require continuous supply of energy. Where this is called for small electrical generators can be attached to the wind wheels. Such units have been devised and exist in the market. Installations for utilisation of wind power have proved successful and inexpensive in use, can be widely distributed and are simple to operate.

Systematic assembly, preparation and recording of meteorological data and installation of experimental wind utilisation units in different parts of the country, with a view to selection of the most appropriate types for use in Haiti are recommended.

3-4
Page 187
4. Small scale engineering and repair

There are obviously no prospects for large-scale mechanical industries in Haiti; but there is room and need for a variety of small-scale engineering and repair shops which may prove profitable, provided, they are efficiently organised, equipped with good machinery and managed with requisite skill. The assistance of technicians with

requisite skill. The assistance of technicians with experience in the operation of such enterprises in economically more developed countries should be of value, especially in the early stages of development of these activities, comprising for example: automobile repairs and repairs of motors and machines of other kinds; operation of jobbing foundries, preferably integrated with machine shops; manufacture--by means of simple lathe operations or small presses of sundry metal goods such as dishes, bowls and other articles of household use, etc...

3.5
(B)
Mr. Lewis Smith's Report

Semi-Artisanal Operations can be improved in a number of ways:

a) By the provision of workshop facilities in selected rural areas for the maintenance and repair of small sugar mills. Most of these mills operate with very low efficiency owing to smooth rollers and no facilities exist for regrooving. Furthermore, as existing mills are in a variety of different makes and sizes, and the replacement parts are impossible to obtain locally, equipment of a local workshop in a centre such as Port-au-Prince to produce a standard locally fabricated mill would be great benefit to the small processes. In India and in East Africa the gur and jaggery mills are made locally and local replacement parts are available. Such a development would be suitable for financing by IDAI and the engineering staff of HASCO would probably be able to advise on the necessary workshop equipment.

3.6
(b)
By eliminating the use of wood as a fuel and improving labour productivity in handling bagasse at syrup and rapadou plants. At present, considerable effort is expanded in carrying bagasse to and from drying areas and appreciable amounts of wood are burnt because of poor combustion of improperly dried bagasse. Figure 8 shows a design and layout which might improve these matters. The furnace design is intended to

feeding less laborious and to give better combustion through control of excess air. The bagasse feed door is a circular plate which will normally prevent entry of air, but can be swivelled on a pin when bagasse is fed to the furnace. Air admitted through the holes beneath the grate can be controlled by hard wood plugs. Bagasse from the mill would be placed in the hot roof of the furnace throat and moved along the top of the flue to the bagasse storage area, from where it should be sufficiently dry to be fed to the furnace. The retaining wall would prevent contamination of the syrup by bagasse dust.

Actual dimensions would have to be worked out by an engineer. Again, finance of a model plant might constitute a project suitable for IDAI.

4. Date of Starting the preparatory Mission

27/12/76 in NAGPUR (India)

6/1/76 in Port-au-Prince (Haiti)

5. Project Site

Institute for Development of Agriculture and Industry (IDAI) in Port-au-Prince (Haiti)

6. UNIDO Contribution US Dollars 10,000

IDAI Contribution - Office accommodation, secretarial assistance, counterpart assistance and transport, etc...

7. Completion date of Preparatory Mission

5/3/76 in Port-au-Prince (Haiti)

12/3/76 in NAGPUR (India)

(II) Findings

8. Main activities of the Project in Summary form

The Preparatory Project was undertaken to prepare the details for:

a. Preliminary phase. research and development of improved implements

b. Phase I. To work-out details for main pilot manufacturing workshop.

c. Phase III. To work out details for possible rural industries.

d. To study Agricultural and Industrial Situation in Haiti.

e. To make a quick survey of indigenous and improved implements available in Haiti.

f. To design at least 2 or 3 useful implements tools for conditions in Haiti.

a) Findings. There is great scope for introduction of improved implements in Haiti provided research and development is given the highest priority as this activity has not even started in Haiti. The farmers are keen to use improved implements and the manufacturers are to keen to produce them. What is wanted is proper guidance for both the farmers and the manufacturers. This can only be given if research and development in at least selected implements is undertaken first.

10. Local Managerial and Administrative Set up is good in Haiti in the form of well-organised Institute for the development of Agriculture And Industry. Qualified and enthusiastic staff is available in IDAI and there is no doubt that IDAI can handle the project provided; finances are approved by the UNIDO/UNDP and other sources.

11. Problems observed in processes applied or equipment used

i. There is lack of repair facilities in rural areas
ii. The implements are not standardised

iii. Identification of improved implements needs to be done after field trials of prototypes.
iv. There is a shortage of raw materials such as steel, iron, coke, etc...
v. The farmers need training in the operation of implements.
vi. To overcome shortage of raw materials, a special raw material bank needs to be established as a branch of IDAI.
vii. The farmers want good bullock power.

12. Availability of skilled labour. is generally available from vocational schools but in-plant training to the labour is necessary.

13. Advice Provided to the Government (IDAI) This was provided in the case of a foundry project in Cap Haitien and in drafting a credit project. The details of these are given in Appendix XII.

14. Specific Achievements. The study envisaged has been completed in the time allotted. Some useful prototypes of implements and tools have been designed. They seem to be promising particularly the maize sheller which can now be perfected. (Fig. 55, 56 and 57)

15. Relationship with other Projects. This has been kept in mind and duplication avoided by suggesting expansion of existing facilities or their proper utilisation, as in the case of 'Outilagri' and the ILO artisans workshops.

16. Cooperation with other UN or Bilateral experts has been sought and obtained particularly of:

i. Mr. Gerard Lambert - Industrial Planning expert UNIDO
ii. Dr. John Callear, Animal Husbandry and Veterinary expert, UNDP
iii. Mr. Engels, Animal Husbandry and Veterinary expert, UNDP
iv. Mr. Courtine, expert in Rural Artisans Training.

17. Involvement of counterpart staff in the project activities. The counterpart Mr. Fritz Michel actively cooperated in the project right from the staff and took part in discussions, drafting the project, arranged

various visits as shown in maps at Figures 53 and 54, and helped in designing the implements. The staff of IDAI gave every possible cooperation and assistance.

18. Project status at Conclusion. The report of this preparatory mission has been submitted to the UNDP/UNIDO, Government and IDAI for final approval and necessary action.

19. Information for substantiating findings and basis for recommendations. This has been discussed in details at each recommendation and wherever necessary, additional information has been given in Appendices along with cross references.

20. Abstracts or summaries of supporting technical reports are given in appendices.

21. Documents prepared during the preparatory project. The detailed report submitted herewith and also quick surveys given in Appendix No. XVII.

22. Implements and tools designed by the expert. The sketches of three implements and tools design can be seen at figures 55, 56 and 57.

III. Recommendations

23) Relation of Recommendations to existing plans

All recommendations have been made, keeping in mind the strategy drawn by the Government in Haiti for the current plan 1961 - 1966, both in respect of Agriculture as well as Industry, and the broad proposals known for the next plan 1977 - 1981. The recommendations have been shown to various other experts in IDAI and UNDP, and their suggestions have been incorporated in the final recommendations. Also the recommendations have been arranged in the order of priorities.

24) External Finances will be required for the implementation of the whole integrated project. In view of the Lima Declaration, Haiti, which is the only least developed country in the Americas and which due to its location, topography, resources, etc... has to face enormous difficulties unlike other countries needs to be given special consideration for external financial assistance and for waiving aside the counterpart contribution.

25) UNIDO's Assistance proposed for the two phases including the preliminary developmental and research work is of the order of US$842,000.

26) Magnitude of Assistance

In addition to the proposed UNIDO assistance of US$842,000, the counterpart contribution of US$355,000 has to be kept in mind and resources located for it. Moreover, an allowance of 15 to 20 percent of the total cost of the project has to be provided if the project is started implementing in later part of the year 1976 as the prices of raw materials, petroleum products, workshop equipment, and the cost of experts are rising daily. The cost of the project has been calculated at present level of prices and may need revision according to the time lag between now and when the project implementation is started.

27) Training abroad with recommended sites

The training abroad to the IDAI officers is considered absolutely necessary. For higher officers the training should be in the nature of observation tours for short durations of 3 to 6 weeks.

For technical staff to man the project, the training should be 8 to 12 weeks, and this should be mostly on-the-job training. The following sites are proposed:

a. For higher officers. Observation tours of India and Japan to observe the progress made in agricultural implements, industries, cooperatives, etc...

b. For technicians in-plant training in Agricultural implements factories also in India and Japan.

For manufacture of Raspadore on-the-job-training in India.

For research and development training in rice implements, the training may be arranged at the International Rice Research Institute, Manila, Philippines.

For tractor and tractor driven implements manufacturing, the training can be arranged in U.S.A., U.K., France, etc...

28) During preliminary part of Phase I, the local artisans can be trained to manufacture the implements by means of simple dies and fixtures.

29) Administrative frame work and skill. As explained earlier in paragraph No. 10, the IDAI administration is good and geared up for a project of this size, and no difficulties are foreseen in this respect.

30) Opportunities for transfer of technology to other developing countries

The words developing and least developed are relative words. No country is permanently least developed or developing. A country may be least developed in a particular sector but developed in others. If the present integrated project is implemented, I am sure Haiti will be able to transfer technology to other caribbean countries which also grow a lot of sugarcane. With specialized manufacture developed here, it may be possible to expand export also. Some problems like shortage of fuel, sisal utilisation, shortage of proteins, etc... may be common to other countries in this region and if solutions for these could be found in Haiti, they may be applied to other countries, particularly

in South America and Africa. The scope for transfer of technology is therefore great, once some practical developments are achieved and once the confidence is created.

(III) RECOMMENDATIONS

The principles kept in mind while making the recommendations

1. That perspective or long-term planning has been kept in mind along with the immediate future. At present the country may be classified as the least developed country (LDC). Because of practical limitations and due to existing socio-economic conditions, the use of human or manual power is suggested for some years to be followed by the use of engine and electric power. Moreover, one needs not wait till a long time for starting the use of engine and electric power. It could be done right from now on large farms, Government centres, on custom or hire basis or wherever possible on cooperative basis simultaneously the use of human or animal power be used on small and medium farms. Therefore, the use of power cannot be rigidly compartmentalized.

2. The implements and tools suggested for introduction and trial on prototype basis have been selected from the known sources in the world. The criteria for selection being whether the implements look promising for Haiti.

3. Some implements have been suggested from JAPAN, India, Burma or Philippines. It is not that these countries come in the category of developed countries but they have passed the first stage and have gained experience in design, testing and manufacture, and this useful experience can be made of use by Haiti so that the mistakes committed are not repeated and no more time and money is lost in gaining the same experience.

4. Maximum possible utilisation of available raw material.

5. Utilising the existing, both public and private facilities, as much as possible without losing sight of the main project and avoiding duplication.

6. Decentralisation as much as is practical.

7. With the aim for export of manufactured goods to nearly countries in the future.

8. Utilisation of scrape iron.

9. Possibility of introducing exceptionally useful new crops in Haiti, which may help soil fertility, control of soil erosion, provision of much needed digestible proteins and provision of fodder.

10. Suggestions for proper utilisation of fuel which has a direct bearing on deforestation and consequent soil erosion.

Keeping these points in view, the following recommendations have been made:

RECOMMENDATION NO. 1

Initial research, modifications and manufacturing selected 8 to 10 implements and main project.

As mentioned earlier, there is, at present, no research or developmental work on agricultural implements. There is no agency which is carrying out this type of work, but such research, testing and modifications of at least 8 to 10 selected implements and tools of immediate importance is necessary to form a basis for any future work. To achieve speed, I would like to suggest selection of 8 to 10 implements manufactured in India, their modification there, getting all templates, fixtures, dies made there and transport by air, all this to Haiti for actual field demonstration and training of workshop technicians. It would be possible to get this work done in India within three-months time and despatch them to Haiti with required spare parts, toolings. At present, infrastructure to carry out such work in Haiti does not exist hence this suggestion to get quick practical results. An expert should immediately follow and come to Haiti for a period of three months, train and demonstrate local engineers and mechanics. This suggestion, if approved, is likely to cost:

1.	Expert in Agricultural Machinery for:	
	a) Selection of implements, tooling, dies, spares, etc... in India - 3 months	
	b) For importing training in Haiti and carrying out modifications in these selected implements in Haiti - 3 months	US$ 20,000
2.	Cost of selected implements, dies etc... and their transport by air	5,000
3.	Demonstration and modification expenditure	5,000
	TOTAL	30,000

An expert also in rural industries, such as for making puffed rice, pop sorghum, etc... may be obtained for a period of 3 months simultaneously so that training could be done at the same time. This will cost about US$15,000. In any case, the total expenditure for such initial practical work, which will give quick results, will not cost more than US$50,000. In view of the fact that Haiti is a Least Developed

Country, and in addition to that, Haiti has many other difficulties and disadvantages such as lack of infrastructure, lack of raw material, hilly nature of the country and shipping almost entirely in the hands of other countries, I think very special consideration has to be given to Haiti under the LIMA Declaration. Then, only practical and useful results will be obtained. The regular programme, as envisaged for the establishment of a pilot manufacturing plant under UNIDO assistance is likely to require at least 2 to 3 years or more for full implementation, as it has to go through the following stages. Moreover, the initial small project mentioned above will be complementary to this pilot workshop as smart designs for manufacture will be available to it.

The stages through the pilot workshop has to go are:

1. Approval of preparatory Report by the Government and inclusion in second five-year plan 1977 - 1981
2. Approval of report by the UNIDO/UNDP
3. Basic appointments
4. Selection of site
5. Construction, provision of water and electricity
6. Import of equipment
7. Installation of equipment
8. Import of raw material
9. Training of high level officers
10. Training of operators
11. Testing and modification of prototypes and final selection
12. Sales and repair organization
13. Extension Agency and demonstration
14. Provision of credit for purchases by farmers and initially subsidy
15. Publication of operation manuals in [redacted] and in French language and use of Radio/Newspaper media

The Main Pilot Workshop project will cost about US$[redacted],000 . It is suggested that the establishment will be done in phases and that the staff required will be recruited as and when required and when the machines have been installed. The project has been

prepared on the lines approved at the Bhabi Clinic and taking into consideration the conditions in Haiti. (48)

The list of equipment has been revised. Wherever the established workshop of Outilagri had equipment already, the same has been deleted from the revised list. New items have been added for fuller utilisation of the workshop for repair and maintenance purposes, also in addition to manufacturing of implements. The workshop cannot subsist. As the demand and the production increase, the workshop is expected to make profit. The revised list of equipment is given below.

A list of Machine Machinery

		Approximate price in HRS
1.	Universal lathe	17250
2.	Bench drill	17250
3.	Horizontal milling machine	3450
4.	Power hacksaw	3450
5.	Upright drilling machine	1150
6.	Screw cutting lathe	9200
7.	Tool grinding machine	2300
8.	Shaping machine	3450
9.	Power grinder	1150
10.	Circular saw	1150
11.	Pipe bending machine	2300
12.	Hydraulic jack	575
13.	Hand metal cutting machine	1150
14.	Shaping machine	1150
15.	Spot welder	1150
16.	Electric welder	4600
17.	Oxy-acetylene gas welder	2300
18.	Arc-welder transformer	2300
19.	Compressor	1150
20.	Power tools	2300
21.	Hand tools	5750
22.	Heat treatment equipment (This is available at Outilagri workshop)	
23.	Tool bits etc	5750
24.	Wood working machines (These are available at Outilagri workshop)	
25.	Blacksmitary machines	12075
26.	Additional equipment as given in the list on next page	[illegible]
	TOTAL	[illegible]
27.	Two mobile workshops (a) 35000	70000
28.	Jigs and fixtures	10000
29.	Testing equipment	5000
30.	Prototype purchases	[illegible]
	TAL for all equipment	[illegible]

Additional equipment for manufacturing and repairing (Item No. 20 above)

Manufacture

1. Power hammer
2. Sheet metal machinery
   - Gilletine press
   - Shearing machine
   - Crimking machine
   - Bending machine
   - Rolling machine
3. Punching and shearing machine
4. Flywheel punching presses for small jobs
5. Handling machine
6. Screw press
7. Double ended grinder
8. Drill point grinder
9. Saw sharpening machine
10. Small foundry for cast iron
11. Small foundry for non-ferrous metals

Repair and Maintenance equipment

1. Portable crane to lift heavy equipment such as engines etc...
2. Battery charging equipment
3. Electric motor rewinding equipment
4. Tyre retreading equipment
5. Fuel injuction pump testing equipment
6. Crankshaft and camshaft grinding machine
7. Cylinder rebering machine
8. Brazer to repair radiator

The above equipment can be obtained in phases and also the staff can be recruited as and when necessary.

After studying the agricultural and industrial situation in Haiti, the production values for identified implements has been estimated as nearly correct as possible under present conditions and is given in the tabulated statement below. More correct picture will be available after the completion of preliminary research and development work is carried out as explained in the first paragraphs of this recommendation.

[redacted]

Year	1	2	3	4	5	Total
Name of implement						
1. Mould board plough (rigid)	500	600	800	900	1000	No 6
2. Mould board plough one way (turnwrest)	200	300	400	500	700	
3. Disc narrows-6 disc	100	200	300	400	500	
4. Ridger ploughs	50	60	70	80	100	
5. Maize sheller (Hand operated)	200	300	400	500	600	
6. Ground nt. decorti-cator	50	60	70	80	100	
7. Digging fork long handled	100	300	600	1200	2000	
8. Fruit plucker	50	200	400	800	1500	
9. Manual seed drill	25	50	200	500	1000	
10. Wheel hoe with attach-ment	25	50	200	500	1000	
11. Paddy thresher	15	50	100	200	500	
12. Sickles (serpettes)	100	200	400	800	1000	
13. Coffee pulper	50	60	70	80	100	
14. Sugarcane crushers	25	30	50	60	80	
15. Trailers	10	20	30	40	50	

Estimated repairs

Name of implement	1	2	3	4	5	
Power driven sugar cane crushers	10	10	10	10	10	
Roller regrooving						
Animal driven sugar cane crushers roller regrooving	200	200	150	100	100	Earlier years more
Tractor repairs	20	20	20	20	20	
Repairs to tractor implements, ploughs, harrows, trailers	10	10	10	10	10	
Cars, trucks, jeeps, of IDAI/[redacted] etc...	10	10	10	10	10	

Abstract of Estimates for the Whole Project

Phase I. Agricultural Implements Pilot demonstration workshop

		US$
1.	**Preliminary** Research and Modification	
	Work including consultant for 6 man months and cost of prototypes, transport charges, expenses for research and modification	50,000
		50,000
2.	**Main Workshop**	
	i. Research and Production Engineer for five years a) 36000 per year	180,000
	ii. Fellowships	24,000
	iii. Equipment as per revised list	270,000
	iv. Miscellaneous including raw material $50,000 and literature and midterm review	60,000
	Total for 1 and 2 above	304,000
	Total for 3 and 4 "	534,000

Phase II. Rural Industries - Integrated Project

i.	Personnel - Consultants	108,000
ii.	Research & Development	18,000
iii.	Fellowships - for higher authorities (observation towns)	18,000
iv.	Fellowships - for technicians	18,000
v.	Equipment - for industries mentioned in recommendations 15,16,17	60,000
vi.	Miscellaneous	[illegible]
	TOTAL	[illegible]

The counterpart contribution is estimated to be:

1. Land..... 25,000
2. Buildings.....200,000
3. Personnel.....100,000
4. Initial raw material..... 15,000
5. Some equipment for rural industries..... 15,000 15,000

As Haiti is the least developed country and as this is the first project of its kind, it is recommended that the counterpart contribution may not be insisted but may be found out from either bilateral source or from UNDP funds. Because of severe handicaps of transport difficulties, lack of every type of industrial raw material (except bauxite), shortage of electric power and many other things Haiti, which is the only least developed country in America, may be exempted in this case from making counterpart contribution and some other source for finances has to be found out if the scheme is to be implemented.

Recommendation No. 2

Animal Power For Agriculture in Haiti

Human progress to a large extent depends on availability of power and how best the available power is used. The power can be obtained through internal cumbuation engines, steam engines, electric motors, solar energy, wind and water sources animal power and human power.

As far as Haiti is concerned for agricultural purposes the major source of power for next two decades will be either human or animal power supplemented to a smaller extent by engine or electrical power for heavier jobs. The other sources of power atomic, solar, wind and water etc. even if developed will be nominal for all practical purposes.

Nearly 70% of farms in Haiti are in the range of 0 to 2.50 hectares. 25% in the range of 2.50 hectares to 6.50 hectares. For these 95% farms virually nothing but human and animal power can be used. For the rest 5% farms, engines, tractors, and electrical motors can be used. Even assuming that the cooperative farming using large machinery succeeds in some areas and the custom hiring in others, still more than 85% farms will depend upon manual or animal power 10% being set aside for custom or cooperative operations. The problem now is how best these 85% farms are to be supplied with useful power.

The application of power enjoins three aspects man - joining accessory - and tool or Animal - Yoke —— and tool. It is only by supplying these three aspects that useful power can be applied.

A paragraph about the serious fuel crisis in the world today will not be out of place here. In fact, the subject of choosing power is directly related to it. Fuel (Gasoline and Diesel) is getting scarcer everyday and its price has increased almost five times during the last 7 to 8 years. There is every possibility of further increases in its price year after year. The economics of use of this fuel has therefore drastically changed particularly for the developing countries. In some countries more dependent on animal power, attention is being seriously paid to the reintroduction strengthening and improvement of the use of animal power on

a scientific basis to offset the cost of fuel to the greatest extent possible, and to some extent success has been achieved in this. It may be remembered that for a developing country the use of atomic, solar and other forms of sophisticated energy is negligible for all practical purposes. The choice, therefore, falls on human and animal power and the earlier they are developed the better it will be.

It is estimated that a human being develops about 0.10 Hp. and a pair of bullocks about 1.00 Hp. Though individually these look small, the cumulative effect is enormous. One other advantage of both these powers as compared to engine or electrical power is that for short periods of one to two minutes both human and animal power can generate ten times more power which helps them to get over obstacles or loads where the engine or the electric motor will stall.

It may also be remembered that agriculture requires power sporadically for ploughing, sowing, harvesting, transport etc. and continuous supply of power as in the case of industries is not necessary.

The second advantage of human or animal power is their adaptibility to both stationary or mobile purposes without much change. In the case of engines a lot of mechanisms are required to make them useful for mobile purposes and in the case of electrical power, it is difficult except when a set of batteries are used, whereas human or animal power can be used for stationary jobs such as water lifting, chaff-cutting, etc. and also for transport purposes or for ploughing (mobile jobs). The bullocks can also be used in tandem - 2 to 4 pairs if more power is required to pull heavy ploughs and ridgers.

One disadvantage of human or animal power is that they cannot generate a specific number of revolutions as an engine or an electrical motor can. This has been offset by designs of bullock gears which can generate about 120 revolutions a minute and are quite useful for cutting chaff or fodder and grinding corn and other cereals.

In the case of human power, proper feeding, good tools, and training in their use can increase efficiency considerably. Very little otherwise

can be done in their case. But in the case of animal power a lot of other things such as breed, age, weight, feed, reins, shoeing, etc. have to be taken into consideration and we will now give greater attention to these aspects.

TYPES: Various types of animals are used for draft purposes bullocks (oxen), buffaloes, camels, mules, horses, etc. Out of these the largest number is bullocks because they can be trained, domisticated and are agile enough and eat roughages. Horses, though they develop greater power require better quality food, green grass and concentrates. Buffaloes are too slow for transport. Mules are good for heavy load-carrying in hilly area. The bullocks are also trained to walk between rows plants for interoultivation without trampling the plants. The mulch thus produced conserves soil moisture in dry land farming. They can also be used for puddling (mixing soil and water before transplanting rice seedings) in wet land paddy cultivation. On the whole, the bullocks form the best compromise in power, feeding and speed and hence they are the most popular. In India there may be about 40 million bullocks giving 20 million Hp. to help the farmers raise crops and this is the power to reckon with. Most of them subsist on the byproducts of agriculture such as straw, sorghum or corn stalks and leaves, supplemented during heavy working seasons with peanut cakes or cotton seed.

Most of the farmers in India and SouthEast Asia possess a pair of bullocks or buffaloes except very small ones. They also have a set of 4 to 10 different types of indigenously made of agricultural implements appropriate to the crops they raise. For example the following can be cited:

1. A wooden plough for dry land farming
2. A wooden plough for wet land cultivation of rice
3. A Steel bladed harrow
4. A peg tooth harrow
5. A heavy leveller
6. A light levelling plank for wet paddy fields
7. A heavy seed drill sowing 3 lines at a time
8. A light seed drill sowing 3 lines at a time
9. A set of interculturing hoes with different sized blades
10. A bullock cart for transport
11. A leather bucket waterlift or a Persian wheel waterlift

12. Pedal waterlift
13. Sickles, knieves, spades, pickages, axes and other hand tools
14. Bullocks alone are also used as implements for puddling and for threshing (by trampling under bullocks feet.)

Thus an average farmers tries to use bullocks for as much time as possible making the use of this power economic for him.

There is however a considerable difference between how the bullocks are used in Asia and in Haiti and the need is to introduce Asian methods to get the best out of this very useful power source. The differences are indicated below:

1) Breeds - In India there are special breeds for draft purposes. Since beef is not eaten in most part of India the cattle are bred for milk and draft. Some breeds are of a trotting type used especially on light carts and are known to have covered about 120 miles in 24 hours during wars carrying supplies. Even now in the villages bullock cart races like the ancient chariot races are held every year. Special draft animals need to be therefore, bred in Haiti. In the beginning beef and draft qualities may be combined but for long range planning there should be a separate breed to give optimum draft. This, it is understood, is difficult under present conditions but may be kept in view as a long term policy.

2) Castration - All draft animals (Bullocks) in India are castrated. Castration makes them easily domesticated and also develops their muscles as against the usual feeling that it weakens them. Castration is painless and requires a small pincer like tool only called BURDIZO CASTRATOR. At the age of about two years the calves are castrated. When castrated the animals are called bullocks otherwise they are called bulls.

3) Shoeing - Like horses the bullocks are also shoed with steel plates on their hoofs which reduces their wear on hard soil. Shoeing is repeated at intervals. The steel plates are fixed by means of nails. This is also a painless job as the hoof is a non-sensitive part. The scrap iron from Outilagei can be used for this, but there is need to impart proper training.

4) Reins - In India, a rope is put through the nostrils of the animal and tied at the neck. This can effectively control an animal both for stopping and starting as well as for turning either to left or to right. With these reins only one man is required behind the plough to handle it and to drive the bullocks. So also in the case of bullock carts. In Haiti for similar bullock cart two pairs of bullocks and two men are required as there are no reins used.

5) Yoke - The method of yoking the bullocks by horns in Haiti has probably come from Northern Europe where in old days this method of yoking was used and also from South America. There is a difference between the anatomy of a horse and that of a bullock. The horse has a strong chest and the power to pull a plough or a wagon is taken from chest. The bullock on the other hand has a strong neck bone just beneath the hump which is merely a store for fat. A well fitted wooden yoke on the neck joint gives better and more draft. In India, various types of yokes were tested by dynamometer trials and the one used in NAGPUR (Central India) was found to be the most efficient. Similar yokes and method of yoking need to be introduced in Haiti if the bullock power is to be put the best use.

It may be mentioned that in Uganda (East Africa) the Government had started a bullock farm by importing bullocks from India and trainers and the bullock are now commonly used there.

For short distances and for less load (about 1/2 ton) the bullock carts in India have been found to be more economical than trucks. Therefore, all short distance transport within 20 to 25 miles is still done by the bullock carts and long distance by trucks. The scarcity of oil and its enormous increase in price recently has again focussed the attention of authorities there to further improve the bullock carts as a means of short distance transport.

It is recommended that:

(A) The Indian system of castration, shoeing, reins and yoking on neck be introduced in Haiti to properly utilise this valuable available power. This can be done in stages and after proper training.

(B) For hilly areas where farmers have small plots or terrace cultivation and where a pair of animals is not required as in the case of a cart . single bullock small implements such as a reverible plough, a small harrow etc. should be designed, produced and used.

In view of the fuel position, the small size of farms, the present and future possible level of mechanisation of agriculture, the shortage of roads the importation of most of the machines and raw materials such as iron, and various other social and economic problems, a policy decision needs to be taken regarding the continued use of bullocks as power for small and medium farms in Haiti at least as an interim measure for next 15 to 25 years. Afterwards, the full mechanisation as in Europe or U.S.A. can be introduced in phases. A beginning in such mechanisation can be made even now for about 5% farms above 6.50 hectares, and wherever possible for cooperative farming and for the custom - hiring of agricultural machines. But for the rest of 95% farms manual power supplemented by the efficient use of animal power seems to be the logical conclusion. The 70% small farms in Haiti (between 0.60 to 2.60 hectares) mostly can use only hand operated implements and tools. The improved ones can be recommended to lent them for 25% farms in the range of 2.60 to 6.50 hectares both bullock driven as well as manually operated implements can be used. Even out of this we regard the target of 25% (that is only 6% farm holding) that will be a reasonable target to start with, expanding after enough experience has been gained.

It is therefore recommended that to start with about 6% of farm holding may be mechanised by bullock powered implements and this target may be fixed for the 2nd five-year plan - 1977 - 1981. Suggestions as to any increase or decrease of this 6% can also be made to make the estimate more realistic.

Recommendation No. 1

Establishment of an Implements Clinic (Laboratory) and a Technical Museum

At present information on types of agricultural implements used in Haiti, their number, local or imported implements and tools is not available. Therefore, a quick survey of the types of existing indigenous implements and the imported implements was made by going through some publications such as the Report of the United Nations, Mission to Haiti in 1949, Bookers'Consultancy Report and making personal enquiries at the known commercial firms in Port-au-Prince. Though such a quick survey is not considered adequate, it has still given valuable information regarding at least the types of implements if not the numbers. During the short time that was available for this preparatory mission, nothing more than this could be done. The sketches with description of the implements, observed as a result of this survey, is appended at annex

In this connection, the attention is invited to page 5, paragraph 'B' entitled "Prototype Implements Supply and Local Adaptation" of the English version of the Draft Project Document for the Consideration of the Government of Haiti, as a result of the deliberations that took place at the Agricultural Machinery Manufacturing Development Clinic held in New Delhi, India as a joint activity of the United Nations Industrial Development Organisation and the Ministry of Agriculture, Government of India in which Mr. Frits Michel, from the Institute for Development of Agriculture and Industry (IDAI) Haiti participated. This paragraph is reproduced below:

"Selected prototypes either already used in the country or obtained from other developed countries and identified in the International Implements Manufacturing Development Clinic held in New Delhi (India) 21 to 30 October 1975, to be tested , and modifications and adaptation undertaken in cooperation with the Ministry of Industry and Directorate of Agricultural Implements. In addition priority of products for local manufacture on a modest scale to be established. This activity to be undertaken through the assistance of one expert under UNIDO for a duration of six months."

As a preliminary step for this activity, it is recommended that a modest collection and study of available implements be made at a suitable place like the Agricultural University at Damien by constructing a small shed of 20 feet x 25 feet and establishing in this shed a clinic and a museum of all the existing implements described in the Quick Survey in Annex . This is not to be a mere display or a museum, but also to act as a Laboratory or Clinic with the following objectives:

1) To study all available implements, collect and record data on them regarding price, source of supply, utility, capacity, power required, etc...

2) To make comparative trials of similar implements to find out which one is better.

3) To lend prototypes to manufacturers who may come forward to manufacture some of them.

4) To assist the future research engineers so that they do not duplicate the work that has been done.

5) To help the extension workers to popularise some of the implements

6) And to inform the farmers and the vocational students about the existence of such implements

On each implement or tool, a separate file containing detailed information should be maintained.

Any existing shed with earth flooring can be used. Later on, its expansion can be undertaken with funds from UNIDO, or other sources. It has been observed in other developing countries that many private firms donate their products for such a museum. A selection committee can be formed for this purpose. Preferably two prototypes of each implement should be collected so that if one is under field test or given on loan to a manufacturer, at least the other remains in the museum. Information may be collected in French, Creole and English Language. This museum will form a nucleus for a larger museum and then to a Research Section and much of the guess work in the future can thus be eliminated.

As and when possible, addition of implements should be added to this Museum and Research Section from all over the world, wherever small im-

plements (manually operated, bullock driven or small power driven implements) are used.

After making a study of crops grown in Haiti, methods of cultivation, problems facing the country, the following implements are suggested for priority buying giving reasons and justification:

1) [redacted] This is a bullock driven implements used by farmers in Burma and made locally by village carpenters and blacksmiths. It consists of a wooden log on which steel blades are fixed. This unit rolls in a wooden frame which is pulled by a pair of bullocks in wet land, paddy field after ploughing it. The width ranges from 3 to 5 feet according to size of the bullocks. The land is first ploughed by a mould board plough and the satoon worked in it twice crosswise churning the soil, burying green weeds and making excellent puddle of soil and water. The advantage of puddle is that after levelling and settling down, it makes the land impervious to water, thus allowing the water to stagnate in the field for better growth of paddy. The heavier particles of soil settle down below and the finer particles on top, making a good seed bed to receive young seedlings at the time of transplanting (Figure 37). Another advantage is that it buries green grass and weed killing it and providing humous and manure to the soil. For better yield of paddy or rice crop, the operation of pudding is necessary and is commonly done in Japan, Burma, India, etc... The same system may be introduced in Haiti.

2) [redacted] As a still simpler alternative to the [redacted] satoon, a wooden or steel peg harrow can be used for pudding.

This peg arrow can be made by a village carpenter.

3) [redacted] Where transplanting of rice is done in regular rows, it is possible to use this paddy weeder to uproot and bury weeds, and for greater aeration. The prongs of this weeder are pointed towards the handle and not towards the front, so that, when worked in the soil, the prongs press the weeds down, suffocate them, and kill them adding that much organic matter which becomes useful for the

growth of paddy. Rice yield can be considerably increased if transplanting is done in rows and if this type of paddy weeder is used. (Please see Fig. Number in the quick survey sheets.

4) [redacted] for germinated rice (Paddy) [redacted] developed at the International Rice Research Institute, Philippines is pulled by man. Can be used in 3 to 5 rows. Germinated paddy seed is sown on puddled field. This obviates the need for transplanting which is a comparatively costly job.

5) [redacted] tool bar implements have been successfully developed by a French Engineer, Mr. Khell and has been introduced in East Africa and Afghanistan. On a simple tool bar, attachments such as plough, harrow, hoe can be fixed.

6) [redacted] implements have been developed in India and cover a wide range. These tool bars were demonstrated at the International Agricultural Machinery Clinic held under UNIDO Sponsorship at New Delhi in October 1974

7) [redacted] at the International Rice Research Institute Philippines use of a diaphragm pump. One man working it alternatively pressing left or right foot. For low lifts of 5 to 8 feet, they are useful (Fig. 41).

8) 'Bouyer' Garden Tractor is made in France and can be used in semi hill areas. It is sturdy with a small diesel engine.

9) [redacted] is similar to Shroyam spade but has [redacted] and gives greater leverage. Foot rests can be fitted on it so that farm labourers, who usually do not have shoes, can work on it.

10) [redacted] is of 2 to 3 feet capacity [redacted] of bullocks and can be used for land levelling.

11) [redacted] is a very simple [redacted] for better soil and water cultivation practices to progress by means of bullock power harrows or tools of about

) feet in height and 6 to 7 feet at the base across the slope so that any rain water that falls is absorbed on the upper side of the bund. The place where the bund is to be raised is marked and about 20 feet from this line on the both sides of the land is first ploughed by using a mould board plough. This loose soil is then taken to the line by a few rise of trips by the bullock driven Kami. It may be mentioned that in one District in India about [redacted] acres of land was bunded by using this implement with the result that now the District that was often preyed to famine grows crops as water is saved and soil erosion is arrested.

In the area where Kami has been used and small stream lets (Khalas) bunded, it has been observed that the water level in nearby dugout wells has risen by 2 to) feet, making that much more water available to the farmers.

Incidentally, in this very area which is now used for growing excellent sugarcane and which has about twelve most successful cooperative sugar factories in India, a novel method of conserving water has been used. It is a combination of irrigation and drainage. The wells are dug on the lower side and by means of diesel pumping sets, the sugarcane is watered on the upper slopes. As water percolates by gravity at least to a certain extent, excess of it goes back to wells again to be used for irrigation (Fig. 36). Probably because of the calcarious nature of the Khitian soils or for alluvial soil, the same system can be tried after ascertaining the soil profile. (Underground strata) Fig.36.

[redacted]
(Fig. 37)

Recommendation No. 4

Implements Recommended for Testing and as prototypes [illegible] for the proposed implements factory [illegible]

Taking into consideration the conditions of soil, climate, crops grown, methods of cultivation and field operations to be performed, there is considerable scope for introduction of improved implements and machines. For this, some infrastructure needs to be developed particularly in the following lines:

1) Research and Development. Simple but useful implements need to be designed and tested on priority basis.

2) Extension Work. Both the extension workers and farmers need to be trained in the use of these improved implements.

3) Standardisation. needs to be followed right from the start, both as regards materials and as regards dimensions.

4) Making available raw material for manufacture of these implements.

The table on page shows the analysis of the size of holdings in Haiti with 70% very small farms of 0.60 to 2.60 Hectares, 25% Medium farms of 2.60 to 6.50 Hectares and about 5% farms above 6.50 Hectares. In the beginning, for the next 10 to 15 years, the first two categories of farms totalling 95% may have to use manually operated and animal driven implements and 5% farms the power driven machines, but this is only a rough distribution. One must keep on eye on progress and include more and more power driven machines in the perspective planning after 10 years or so. Also there is no such thing as exclusive sphere of the use of manual, animal and power driven implements. Even from now, a combination of these can be used. For example, the power driven machines can be used on cooperative or custom basis on smallest farms, if properly organised. It is, therefore, recommended that a judicious combination of all the three types be used throughout of necessity and compulsion due to circumstances for the next 10 to 15 years the greater emphasis should be on manually operated and animal driven implements. Thereafter, as the circumstances demand the emphasis be shifted to power driven implements in phases.

In the following pages are given four separate lists of implements, tools and appliances which look promising for introduction in Haiti. These lists are given for consideration of the authorities for obtaining 1 to 5 prototypes for testing, field trials, demonstrations to farmers, and to be used for any required modifications and adaptations, and ultimately as prototypes for local manufacture in Haiti.

1. A list of power driven equipment
2. A list of animal drawn implements
3. A list of manually operated tools and implements
4. A list of miscellaneous items which have been included to properly utilize the byeproducts of agriculture and forestry and conserve wood and coal—the supply of which directly affects soil erosion which is a serious problem in Haiti. Two items suggested are about the use of sisal fibre to make closely woven cloth and sisal crafts—a coal tar impregnated cloth. The closely woven cloth can be used for sack making and the coal tar impregnated cloth for roofing, partitions, flooring seed stores, etc... These may give fillip to growing sisal again in Haiti and lift up the rural industry. The soil on hill tops and slopes is most suitable to grow sisal and it does not require much care being a semi-desert crop. Moreover, nothing else can be grown on such soil and growing of sisal may prevent soil erosion. Hence the importance of this suggestion.

Regarding improved but simple stoves, both for wood and charcoal, if introduced, they can save considerable fuel which is in short supply and when the forests need to be conserved. Even if 10 to 15% wood and coal can be saved by these stoves, it will help the national economy.

It is recommended that all or most of the machines, tools, and implements mentioned in the four lists be obtained and placed in the proposed laboratory or in a museum for further processing for testing, modifications, manufacture and designing, wherever necessary.

(I) (36)

Possible list of implements, machines and tools

Power driven equipment. Preferably on cooperative basis or custom basis

1. Wheel type tractor 25 to 50 H.P. with cage wheels and a nine or eleven type cultivator for puddling
2. Wheel type tractor with a disc harrow for dry land cultivation
3. Wheel type tractor with a trailer for transport
4. Powertiller with rotovator
5. Powertiller with trailer ½ ton
6. Powertiller with centrifugal pump
7. Powertiller with verticle pump
8. Powertiller with sprayer and duster
9. Use of tractor as power for road-roller (concrete)
10. Knap sack type power sprayers
11. Diesel driven centrifugal pumps
12. Electric driven centrifugal pumps
13. Chaff or fodder cutter
14. Sugarcane crusher
15. Small cotton ginning machine (roll or saw)
16. Leveller blade for wheel type tractor
17. Chain harrow for wheel type tractor
18. 'Bhoomi' small tractor from France

(E)

Animal driven equipment

1) Turn wrest mould board plough light (Ransomes from U.K.)
2) Care Plough (Junior and Senior)
3) Wedge type steel plough
4) Disc harrow-6 discs
5) Bladed harrow
6) Expandible cultivator
7) R.N. cultivator set
8) Ridger plough
9) Seed-cum fertiliser drill - 3 rows
10) Washer waterlift
11) Persian wheel waterlift
12) Sugar cane crusher
13) Burmese Satoon for wet land paddy cultivation
14) 'Ariana' tool bar set (French design)
15) Nagpuri Yoke, Long Beam
16) Peg tooth harrow
17) Bullock gears with universal joints
18) Kuni for bund making
19) Soil scoop or scraper
20) Levelling log with steel prongs
21) Toother harrow or cultivator for wet land paddy cultivation
22) Bund former
23) Laos plough

(38) (39)

Manually operated implements and tools

1. Light sarata type drill - Manual
2. Light sarata type drill - Automatic and like planet junior small planter
3. 3 or 4 pronged diffing fork
4. Weeder attachment to machette
5. Digging fork with foot rest
6. Digging spade with foot rest
7. Light ridger
8. Light blade harrow
9. Maise shelter - Hand operated
10. Maise shelter - Palm type
11. Ground nut decorticator or peanut sheller
12. Dibbling frame
13. Bicycle driven paddy tweshor
14. Bicycle driven winnowing fan
15. Bicycle driven grinder
16. Steel winnower without sieves
17. Hand driven winnowing fan
18. M.B. 2 type (clipper)grader
19. Iranian spade
20. Japanese paddy weeder
21. Japanese Straw softener
22. Japanese rope making machine
23. Japanese mat making machine
24. Sugar cane crusher
25. Knap sack type sprayer
26. International rice research Institute pedal waterlift
27. International Rice Research Institute geminated paddy planter
28. Hand flour mill
29. Pickaxes
30. Spades
31. Chaff cutter circular

32. 3 pronged hand hoe
33. Kami or levelling blade
34. Patola with hooks
35. Soil scoop
36. Punjabi wooden kami
37. Small cotton gin
38. Sprayers
39. Dusters
40. Fertiliser spreaders (hand)
41. Small hand pump for shallow and also for deep wells (most needed)
42. Manure fork
43. Rake
44. Garden tools - shears (lopping, pruning)
45. Garden tools - Grafting and pruning knives
46. Fruit picker for mangoes and oranges, limes
47. Small hammer mills
48. No. 5 coffee huller
49. Peanut pod separator
50. Maize, sorghum grinder
51. Paddy thresher pedal operated
52. Paddy thresher expanded metal semi-circular
53. Grain cleaners and grades - KD-2 Clipper (USA) type
54. Wheel winnowers with a set of sieves
55. Sorghum thresher
56. Hand coffee pulper (disc or cylinder) comparing to No. 6 Model
57. Sickles (serpettes - Elwell type made in UK)
58. Different types of machettes
59. Sisal or agave decorticator - to take out cellulose and get fibre

Technologies, appliances and items

1) Indian charcoal stove and saw dust stove
2) Indian wood stove - one and two chambers
3) Coal dust briquettes making machine
4) Sisal cloth coal-tar impregnation equipment
5) Equipment for making puffed rice, pop sorghum, pressed rice, etc...
6) Equipment for rope making out of sisal and coconut
7) Equipment for drying mahogany wood by means of solar energy

Recommendation No. 5

The Group farms of Uganda

Mechanisation of small farms anywhere is a great problem, more so if the farms belong to illiterate peer farmers. Various solutions have been suggested to overcome these difficulties. Some more important of these are discussed below.

(1) Communes - As in some socialistic countries where the land is owned by the State and the farmers become workers. To the farmers who take pride in owning a land however small or improductive it is such a system will not be acceptable particularly in Haiti.

(2) Cooperative Agriculture is all very good in theory but in practice it fails except in some areas where proper leadership and training is available.

(3) Custom hiring of agricultural machines has succeeded in those places where there is enough work and profit for the individual entrepreneur or by the Government units or by big estates. It is understood that HASCO has a fleet of Caterpillar crawler tractors which plough the land of the sugarcane farmers and at the time of the purchase of the cane deduct the expenses for such jobs done.

(5) Group Farms which have been started in Uganda (East Africa) have most of the advantages of the above methods and yet they are suitable for socio-economic conditions in a developing country like Haiti. There are many similarities between UGANDA and Haiti regarding the people, the climate, the soil and the crops and if it could succeed in

Uganda, it could succeed here at least in selected places.

The main advantage in this system is that it does not disturb the status of the farmer as an owner of his, and therefore it is more acceptable to him. The land is owned individually by the farmers.

The second advantage is that by combining together to own machines they can afford to employ trained operators who can maintain the machines properly. A group of farmers combine, raise capital to purchase such modern machines as tractors, trailers, sprayers, ploughs, harrows, seed-drills, etc...establish a common service centre with a manager and trained operators. The whole cropping pattern of the area for the next 2, 3 years is planned taking into consideration crops to be grown, export possibilities, etc... and giving sufficient freedom to the farmers. According to the work load, the machines are provided. To be successful, such planning has to be done very carefully so that during rush hours, sudden demands for particular machines do not develop. Even though the farmers may be less educated, the machines being operated by trained operators, are maintained well. Rates for jobs, works, are fixed and every farmer has to inform the manager before hand for doing particular jobs so that he plans it with the least unproductive movement.

By using this Group farm method, the farmers in Uganda have been able to grow long staple cotton of fine Egyptian type and enter into contract with foreign countries for its purchase of it for

the next five to ten years; thus assuring them of steady income.

It is suggested that this Group farm system be studied and a pilot project in a suitable area, particularly in cash crop areas like cotton or sugar cane started in Haiti so that mechanization of agriculture gets a good fillip.

Recommendation No. 6

Accessorization features and Establishment of a [redacted]

It is recommended that educated unemployed may be given short-term practical training in the operation and repair of machines such as power-tillers and accessories like trailors, sprayers, pumps, etc... After the training, they may be given loan at concessional rate of interest to purchase these machines. There is a lot of demands for powertillers in the paddy growing area in Artibonite Valley. As the farmers are with limited resources and as their farms are too small, it is not possible for them to purchase such machinery and own them individually. They can, however, pay hire charges for getting their land ploughed or puddled by this entrepreneur who would charge them for work done on hourly basis or on acreage basis, which will ever suit them best. With a trailer, he can carry the paddy to rice mills or can spray the crop with insecticides, thus finding him enough work throughout the whole season.

A few such centres may be started in the Artibonite Valley. Initially, it is suggested that 10 or 20 powertillers with accessories be imported. It is advisable to import [redacted] of a sturdy machine which is not too sophisticated for use in rural areas. Twenty per cent quick moving spare parts and five percent slow moving spare parts may be imported along with with these machines so that there is no difficulty of spare parts for about 5 to 6 years. After a year or two, another set of spare parts may be ordered so that they come in time. A safe gap of at least one year should be maintained for the supply of spare parts so that the machines do not remain idle for any length of time.

In the meanwhile local artisans and small workshop owners may be asked to make locally at least the simple spare parts. After 6 or 7 years, the demand for powertillers may rise that steps may be taken to manufacture them in Haiti by farming out the parts to Haitian manufacturers and importing some. For assembly of powertillers, there already exist two big factory type sheds in that area housing an old rice mill which is not being used at present. By using trolley type assembly system, not much of other equipment will be re-

quired for such an assembly plant. Since the shops for assembling are located in an area where there is likely to be the largest demand, the transport charges will be saved. The plant for manufacture of diesel engine and transmission system can then be integrated by expanding the main plant workshop recommended to be established under the UNIDO aid and springs, engine wheels, sheet metal parts, types of rotavators can be made in village, which will by then have all the sheet metal machinery under its expansion programme.

The engines and transmission need to be standardised right from the start. The same engine can then be used for operating centrifugal pumps, sugarcane mills, for small fishing boats and the like. Such an engine would be of about ten brake power.

[redacted]

(96)

It is recommended that [redacted] which requires no other power such as from diesel engines or from the electric motors be installed to raise water from streams in the mountain areas where small waterfalls exist or where there is sufficient head to generate the pressure. A survey of such areas will have to be made and the hydraulic data collected. Hydraulic ram is a simple water lifting device.

[redacted]

Possibility of generation of electricity by wind power, wherever there is continuous strong wind (more than 10 miles per hour), may be explored. After collecting the wind velocity data, some places in suitable areas may be selected to generate electricity for pumping of water.

There is one such machine already working at Kumandi near Port-au-Prince.

Recommendation No. 9

Earth Moving Tools

In Haiti earth is required to be moved

for a) Agriculture - movement of earth, clay, farm-yard manure

- movement of boulders and soil for gulley plugging, making terraces for conserving soil and water and for checking soil erosion which is a very serious problem in Haiti

for b) Road repairing and making

In industrially advanced countries, various types of earth-moving machinery such as the bulldozers, scrapers, graders, worked by diesel power are available. Initial high capital and the high cost of diesel (which has risen by 3 to 4 times during the last 5 to 6 years) and the lack of facilities for repair and maintenance make it difficult for its general use in a country like Haiti where the task is enormous, it being a hilly country. Animal powered equipment, as used in Asia, is also not available here. Allowing the modern earth-moving machinery to do the work on major roads such as Port-au-Prince to Cap-Haitien, Port-au-Prince to Cayes, etc... the other roads in the interior can be made and repaired only mobilizing human power that is available, which also provides employment to rural people.

The wheel barrows are useful on fairly level and firm ground, and can be handled by strong men. But in agriculture and in road making, such conditions are not found particularly in the topography as in Haiti. Moreover, wheel barrows cost much, require maintenance of wheel axles and bearings to be efficient and require much steel to manufacture. Maybe for the work of road maintenance, they could be used, but for gulley-plugging, making terraces and other soil conservation practices, they are not useful.

The Haitian labour is used to carry head loads in palm leaf baskets which are useful to carry grains, fruits, vegetables, etc... but they cannot be used to carry earth, manure, boulders, sand which are heavy and which damage

the baskets quickly. In its place, use of steel baskets or pans (Figure 43), slightly smaller in size so that women can lift them and carry, are recommended. They are made by pressing mild steel and can easily carry about one cubic foot of earth, and can last for 8 to 10 years. Though one cubic foot is a small quantity per head load, the cumulative effect of being used for say eight hours and for moving at an average distance of 15 to 20 horizontal feet and 5 to 10 vertical feet is quite adequate. This work should be organized in gangs of 2 to 3 men and 7 to 8 women and in the following fashion, as done in India:

1. Digging by pick-axe - 2 men

2. Filling the baskets by a short-handled spade and lifting them on women labourers' head --one to two men

3. Carrying and emptying the load by women (average lead 20 feet and height difference of 10 feet)

The same type of Haitian spade can be used for filling provided short handles of about 3 feet in length are fixed instead of 4 to 5 feet as done now.

One difficulty is anticipated in the use of the steel baskets, the discomfort to carry heavy loads on bare heads. Asian women keep long har which act as a resilient and springy layer between head and the bottom portion of the steel basket. In Haiti the women mostly have short curly hair. To make the head loads carrying more comfortable fixing or of rubber ring beneath, the steel basket is recommended or folded cloth as used in Haiti can be put under. A ring of 6 inches diameter made of solid rubber, 1 inch diameter will be suitable. It can be fixed as shown in the diagram on

With little training, such teams with only simple tools such as pick-axe, short-handled spade and a steel baskets or pans can help in earth moving

Use of bullock driven implements to prevent soil erosion and for conservation of moisture

The gulley plugging has to be done by manual labour as suggested earlier. For making terraces on farmers fields, the mould board plough and an implement called Keni (Fig. 44) is recommended. The mould board ploughs are going to be introduced in Haiti for ploughing. The same can be used for this operation also in combination with 'Keni' which is a simple and cheap implement of mild steel. First, a central line is marked where the bund or terrace of about 3 feet in height and about 6 feet at the base is to be formed. On both sides of this line, the land is ploughed by a bullock driven mould board plough of about 20 feet in width. This loose soil is then carried over to the Central line depositing the soil from one side fi first and then going over to the other side and bringing back the soil from that side. Gradually the bund of required height is formed across the slope of the land or on contours preventing its washing away and allowing the water to seep in more and more (Fig. 45). More moisture is therefore available for crop growth in rainfed areas. Also in the case of gulley plugging and formation of such bunds or terraces, it has been observed in India that water table in the nearby open wells has risen by two to three feet making that much more water available for irrigation.

Recommendation No. 10

Standardisation of Implements

There is no standards organisation in Haiti but it is advisable right from the beginning that the agricultural implements and tools produced in Haiti are so produced that the uniformity of product is maintained and the inter-changeability of parts possible. It will, therefore, be useful if standard specifications of simple implements and hand tools are obtained from the National Standards Institutes of Countries like India, Japan and some countries in Europe, who still use, through partly, the hand tools. After making a comparative study of these, the most suitable for the Haiti conditions may be adopted. A comprehensive list of standards available from India is given in Appendix IX. All these standards may be obtained from the Indian Standards Institution, Manak Bhavan, Mathura Road, New Delhi (110001). Most of these implements with or without modifications may be able to be adopted for Haiti.

A beginning for standardisation can, therefore, be made this way in Haiti till some permanent organisation takes over this work in the future.

At a later stage to this standardisation can be added Inspection and Registration as and when the agricultural implements industry develops. The national standards thus evolved should try to coordinate the requirements of three interests, namely producers, consumers and technologists, thus securing the required delicate balance between the three and thereby ensuring that the standards are based on the current state of scientific knowledge, permit production at economical level and serve the needs of consumers or farmers in general.

Recommendation No. 11

Solutions for Saving Domestic in Fuels

In Haiti the question of domestic fuel is closely related to the serious problem of deforestation and consequent soil erosion. This is though a small subject--minor due to its domestic use has assumed such a proportion that both in designing and also in training highest priority needs to be given to it. Any attention paid to this problem, this simple problem, though it looks and rather unglamourous, will pay devidents many times. Making of improved domestic stoves will add appreciably to rural industries. Hence some solutions are recommended here and the problem is attacked from every possible side on the assumption that Gas or Electricity for domestic cooking in vast rural areas is out of question for the next 20 to 30 years, though they may become common in five or six main cities in Haiti.

1) Improved wood stoves (Fig. 49). At present, three stones are placed in the open and wood lighted for cooking or for heating water. In its place, a single chamber or a two-chambered stove made of mild steel or from clay may be used. The heat is conserved in such stoves and the draft is made use of for heating the second pot. Wherever clay is available, these could be made out of clay and they last about a year. Clay is mixed with cow-dung and some finely cut straw so as to prevent cracking and the stove made by hand. After drying fully it can be used. If made of mild steel, it will be more or less permanent.

2) Improved Charcoal stove (Fig. 46 - a) in which the draft is adjustable and the quantity of charcoal to be used is also adjustable. The grate made-up of mildsteel rods of $\frac{1}{2}$" to 3/4" diameter and rests on 3 or 4 steel studs. When the rods get broken after a year or so, the grate can be changed. The door hinged to the cover is used for adjusting more or less draft of air. The spare ring is for reducing the consumption of coal, if only a small pot is to be heated. The price of such a stove in Haiti if

made in rural industrial workshops will be less than five US Dollars.

3) Stove for use of wood saw dust (Fig. 46-b) Wherever it is available as in wood sawing mill or in wood workers shop.

4) Use of Charcoal dust (Fig. 48) which goes to waste in charcoal kilns or in charcoal stores. The dust is mixed with wet clay in proportion of 3/4:1/4 and passed through a briquettee making machine, making low grade, but useful coal again. These machines are in common use in India and the low-grade coal is used for slow cooking or by poorer people. The machine consists of a screw arrangement through which the misture of coal dust, clay and water passes under pressure and comes out as solid pieces which, after drying, are used as fuel.

5) Paddy Straw Box cooker (Fig. 47) In Haiti both rice and sorghum are boiled for eating. If the vessels containing grain and water covered with a lid are placed in wooden boxes lined by a layer of 6" paddy straw and kept overnight, very little cooking on charcoal stove is required the next day. The heat produced by paddy staw virtually does the cooking without the use of any other fuel.

6) Use of simple pressure cooker of aluminum will save fuel. Though the lid is not tight enough to prevent loss of steam completely, it hastens cooking of rice and millets. It is advisable to have some type of safety valve on the lid so that too much excess steam, if produced, is let off.

(52)

Recommendation No. 12

Equipment for small rural industries based on local products may be introduced:

1. For puffed rice
2. For pressed rice
3. For pop-sorghum
4. For pop-cicer arietinum - Pois chiche
5. For ground nut (Peanut) and jaggary toffees (raw sugar made at farmers'level

The equipment required is very simple and does not cost more than US$50 each. A person with practical experience in these processes may be recruited from India for a period of three months. He or she may be allowed to bring one set of equipment to Haiti by air. The total weight will not be more than 100 Kgs. The raw material such as rice, sorghum, and groundnut are available in Haiti. Pois chiche has been recommended to be introduced because of its high protein contents. Rural industries on very small scale can be thus started in Haiti. This will also help nutrition programme, particularly for school children. The training here in the first instance may be imparted to the home economic students and in turn, they will train people in rural area--mostly women.

(5.)

Recommendation No. 11

SISAL UTILISATION

Sisal grows very well in Haiti and in areas where nothing else can be grown. The farmers have experience of growing sisal. With the production of artificial fibres for rope making such as "Nylon" the demand for sisal fell appreciably. But the conditions have now changed and one can anticipate that there will be greater demand for sisal in years to come due to shortage of Nylon which is a petroleum product. The sisal production in Haiti is likely to pick up and if it is utilised also for home consumption in the two ways mentioned below, there would be steady and continuous demand for sisal for next 25 to 30 years thus helping the farmers and the rural industries.

1) It is recommended that Sisal Craft may be manufactured in Haiti. It is a strong sisalcloth impregnated with coal tar which is said to be available readily in the Westindies. After such treatment and drying it makes an excellent water-proof canvall-like material that can be used for roofing of huts, partitions, flooring to prevent dampness, covering grainstores, and covering corn bunches hung for drying on the trees in rural Haiti. Galvanised iron sheet roofing is imported in Haiti and is not only costly but of low quality, rusting very quickly in the tropical climate. If good quality sisal craft is produced in Haiti, it will help solve one of the problems of rural housing and grainstorage. The vermins and white ants do not attack such coaltar impregnated canvass made of ... sisal.

2) It is recommended that closely woven sisal cloth be made either of pure sisal or sisal combined with old cotton yarn or coconut fibre so that the sacks can be made out of this material to carry ... sugar, fertilizers, wheat flour, etc. At present, a loosely woven sisalcloth is made in Haiti which is useful to carry rice, millets, peanut, etc. But for sugar, fertilizers and for wheat or corn flour a closely woven cloth is necessary. The same can also be used to store raw sugar or gaggery called (Gur in India) when it is made here. Normally bumps of 25 to 30 kilos of such raw sugar can be stored in one such bag.

Sisal cords are most suitable for Tatti and since plenty of it can be grown here, the above suggestions have been made. Rope making machines of Japanese type can be introduced to make ropes from sisal and coconut fibre. This can be one of the industries that could be started in rural areas

[redacted] No. 14

Introduction of Pois Chiche = Cicer arietinum

It is recommended that this very useful crop be introduced in Haiti. [redacted] It is a legume crop of very hardy nature, and [redacted] as a source of [redacted] [redacted] In India it forms one of the main food crops. It is called there as horse gram as it was fed to horses in ancient times as a concentrate. It is used along with sorghum and wheat as chief human food and makes an excellent combination with peanuts. Being a legume, it adds to the fertility of the soil and its leaves are good fodder for cattle. It grows well on hill slopes and even on poor soils. Its botanical description taken from 'Encyclopedie Biologique' is given in Appendix X.

If grown, it can add one more rural small industry for roasting the gram which has good keeping quality. Toffees can be by combining it with peanuts and raw sugar or jaggery or called Gur in India and is extremely nutritions in supplying proteins to a young population. It is also very cheap. The climate and soil in Haiti is suitable for its growth and since this is a hilly country, the most suitable elevation can be found out by field experimentation. The seeds of 2-3 varieties of this crop may be obtained from India.

Recommendation No. 15

Manufacture of Raw Sugar - Rapadura

IDMI had shown great interest in knowing about equipment and processes for manufacture of this type of raw sugar. Unfortunately due to shortage of time detailed examination of this subject could not be carried out. However, some centres where this type of raw sugar is manufactured in crude form were visited and the existing equipment seen.

The main observations are that the design of the furnace needs to be improved to make use of sugar cane baggasse as fuel instead of wood. The grate, flue, and the pans also need changes. It is more economical to use large shallow pans which allow evaporation of juice rapidly. To clarify the juice leaves of Lady's finger plant (Hibiscus esculantous) need to be added so as to get clear yellow colour sugar.

Regarding sugar cane mills the following data taken from Mr. Louis Smith's report is self-explanatory. Most of the mills are old and the rollers are worn out.

Animal Power Mills (For sugar cane)

Animal powered mills of the type shown in Figure 2 are common in the Plateau Central and in parts of the Department du Sud. These mills consist of 3 vertical rollers which may be metal or wood and are actuated by a pair of animals, usually bullocks. The cane is passed by hand between the rollers, sometimes up to 6 times and the juice is collected in a shallow wooden through below the rollers.

Cast-iron mills for animal traction were imported, but are no longer available. Being grooved they are more efficient than the smooth, locally made, wooden mills. The extraction of juice depends upon the number of times the cane is passed between the rollers, but is unlikely to exceed 50%.

Hauling Antimony

According to a return furnished by the ad-

ministration Générale des Contributions to IBMI, the numbers and locations of mouline-à-cannes registered with the administration are:

Data on Power Cane Mills

Position	Moteur	Traction Animale
Cap Haitien	9	230
Port Liberté	-	37
Petit Goave	5	24
Port-au-Prince	15	13
Léogâne	16	--
Ville-Bonheur	-	32
Mirebalais	31	328
Jacmel	--	12
Saint Marc	--	13
Hinche	3	477
Jérémie	2	99
Miragoâne		117
Aquin	1	66
Les Cayes	[illegible]	[illegible]

Power Cane Mills

Number and Distribution

Thus there would appear to be at least some 90 power driven cane mills and 1645 operated by animal traction. As may be seen from Annex 10, the power mills are mainly in Port-au-Prince - Léogâne and Mirebalais area while the animal mills are concentrated largely in the Mirebalais/Central Plateau region.

Type and efficiency

Motor Powered Mill. The bigger factories have 6 to 9 roller mills but all others consist of a 3-roller mill sometimes preceded by a 2-roller crusher, belt driven by a diesel engine. Most of these mills are in the size range of 9" x 12" to 14" x 20" with a maximum capacity between 1 to 3 TCH and the diesel engines are usually of 12 or 15 h.p. One would expect juice extraction of 60-65% from a three-roller mill and possibly over 70% if preceded by a crusher. However, the majority of the mills seen were in poor condition, it is doubtful

if more than 50% of the juice in the cane is being extracted, although in some cases the cane is passed through the mill twice. The mills are of overseas manufacture replacement parts are virtually unobtainable and there appears to be no local facilities for repairs to mills and re-grooving of rollers.

Regarding the repair facilities, attention has been given to include them in the main or mill or mobile workshop set up proposed in this report. It is recommended

a) That best makes of sugar cane mills be imported as prototypes for manufacture. Three types may be imported.

i) Bullock driven
ii) Bullock driven which can be converted to power driven
iii) Large power driven

All these types of standard sugar cane mills are available in India. The rollers should be made of high grade semi steel and the axles should be accurately ground and forced into the rollers under hydraulic pressure. All rollers may be properly grooved.

b) Improved types of furnaces such as Shadhumbi or Anakapalli (India) may be built here and used.

c) That some of local workers may be sent on training and observation tours to India. The workers to take training on the job and officers to observe various of [redacted] working of sugar cane. It is [redacted] Director of IISI, the Director of Division of Industrial and Development may be sent as high level delegation for such an observation tour for a period of about one month to India. The Director of Industries Division and one practical worker may be sent for similar period to India for on-the-job training in manufacture of Khandsari. Such a training would be very useful in establishing this rural industry in Haiti. In the phase II project funds for such observation tours and training have been provided.

(7)

[redacted]

[redacted]

In the Anuradhapura Valley where rice is grown, the paddy straw after harvesting is allowed to remain in the field. Only earheads are cut by hand in harvesting. It is possible to make use of this paddy straw to make ropes, mattings and cadjan, as they do in Japan. For this purpose, it is recommended that Japanese paddy straw rope making and straw softening machines be imported. The rope making machine may be pedal operated and the straw softening machine may be hand operated. A small loom to make mattings out of these ropes should also be imported.

The same machines could be used for coconut coir rope making. These two would add to useful rural industries making use of locally available raw materials. It is also recommended that during the observation tours of higher officers to India as suggested in recommendation No. 15, they may visit Kerala in Southern India and see how coir ropes are made on family industry basis. At present, coconut coir is not used in Haiti. Brushes from the coir fibre can also be made in small rural industries.

Recommendation No. 17

Drying of Mahogany wood by Solar Energy supplemented by [illegible]

Mahogany wood is used in making world famous wood carvings of Haiti. It is a hard wood and before carving needs drying and seasoning. It is recommended that one pilot shed be erected to season this wood by means of solar energy, as there is plenty of heat during dry summer months. For this purpose, black polythene cloth may be used to catch and heat the air which is passed through the shed around the wood to be seasoned. Such imported black polythene sheets and tapes to join them are available in Port-au-Prince. During rainy seasons baggasse fuel may be used to get hot air in the shed. A combination of solar energy and baggasse fuel will be ideal for all the year round drying process.

Tourism is increasing in Haiti day by day. As good roads are built, there will be more tourists and greater demand for wood carvings which is a developing rural industry. Properly seasoned and dried wood if given to rural artisans, it will help them produce articles of better art and craft.

[redacted]

[redacted]

All existing manufacturing and training units have been taken into consideration, to see that there is no lop sided development of any particular part, nor concentration in one area. More backward areas have been given special consideration. It will be seen that if developed on the suggested lines all crops and all areas in Haiti are covered within the financial limitations.

1) [redacted]

(possible finances US $500,000) may be located in Port-au-Prince adjacent to Cantiague workshop supply of electric power, raw material, qualified staff are some of the considerations that made this choice of the location. For the sake of decentralisation alone one cannot locate it elsewhere because qualified persons normally do not like to work in very rural areas for lack of educational and health facilities. Moreover supply of power and import of raw material are also to be considered.

2) [redacted] - This workshop is at present manufacturing implements of good quality. It is a joint project financed by IBRD and a private party. Manganese steel is imported. I feel that IBRD has made a very wise decision in financing this workshop. It should be expanded for making all sheet metal parts of implements such as mould boards, shares, discs of disc harrows, blades for chaff cutters, and for powertiller rotavators. The machinery that is already available at Cantiague has not been duplicated in the main Pilot manufacturing workshop. In fact, Cantiague may in future be a subsidiary of that main workshop.

3) [redacted] - Two numbers have been suggested [redacted] locations and may be placed in Central Plateau one in the south.

4) [redacted] were started earlier under [redacted]

a) Lens - near Jeremie
b) Port Jacques near Port-au-Prince
c) Gonaives near Les Cayes

a) Pont des Nègres near Ranquitte
b) Lagunes near Port-de-Paix
c) Palmiste near La Source
d) Petite Rivière de Nippes near Ranquitte
e) Chantal near Les Cayes

All these can be further developed and utilized for training, repair work and for small scale manufacturing. I have visited the workshops at Chantal and at Camp-Perrin near Les Cayes. They have good sheds and equipment. The workshop at Camp-Perrin has been closed due to some difficulties. Special courses for repair and maintenance of agricultural machinery can be started there and they can be developed as to good maintenance workshops not only for agricultural machinery but also for other rural industries and requirements of rural people.

f) [redacted] - people such as
a) Foundry in Cap-Haitien (Owner - Mr. Celestin)
b) workshop near Cayes belonging to a blacksmith
c) workshop at Laborde near Les Cayes started by Projet de Développement communautaire Chrétien by Mr. Raymond Jean to do some good work in manufacturing ploughs, etc. It is worthwhile to strengthen this workshop
d) Haiti Metals and National Foundry workshop in Port-au-Prince can also be utilized for job works.

The first two workshops can be protected by giving loans by IBAI and by proper technical guidance.

g) [redacted] - That may be started by
a) [redacted] in Artibonite Valley for doing custom work by powertillers in rice fields as suggested in recommendation No. 6
b) One of two group forms as suggested in recommendation No. 5.

Thus if an overall picture of Haiti is taken, it will be seen that the manufacturing, repair and training facilities could have been adequately diffused throughout the whole country and the best use could have been made of all existing or proposed facilities both in public or in private sectors. This will apply to agricultural implements and also to rural industries.

[redacted]

[redacted]

ID / [redacted] / 79/[redacted] 11:[redacted] / 01 ([redacted])

(i) [redacted] - Expert in Agricultural Machinery and implements

(ii) [redacted] - 2-3 Months

(iii) [redacted] - As soon as possible (Positively before 31st December 1979)

(iv) [redacted] - Correspondence with Govt within the country.

(v) [redacted] - To assist the Government in formulating an integrated programme for local development of agricultural machinery and implements including possible establishment of a pilot demonstration manufacturing plant.

(vi) [redacted] - The expert will be attached to the Institute for Development of Agriculture and Industry ([redacted]). The expert shall work with the officials of the Centre for Planning ([redacted]), [redacted] and with officials of Ministries of Industry and Agriculture.

He shall carry out the following tasks : -

__ Assist [redacted] in identification of products which have a local demand, establish product specifications and market demand.

__ Identify those tools and implements which could be locally fabricated. Establish product mix volume, order of priority and a preliminary production volume.

.../2

— Elaborate a project for local manufacture of agricultural tools including design development, adaptation and testing; repair and maintenance and service and training.

— Recommend ways and means of accomplishing the recommended objectives and plans including possible UNDP/UNIDO assistance.

(V) [redacted] : — Degree in Agricultural Engineering Professional experience in Product, identification, manufacturing feasibility study, Production through appropriate technology with special reference to simple agricultural tools.

(VI) [redacted] - Spanish and English

(VII) [redacted] — The Government of HAITI, participated in the Joint UNIDO/and Government of INDIA "Manufacturing Development Clinic of Agricultural Implements and Machinery for Least Developed Countries" (23-30 October 1976), NEW DELHI. The Government of HAITI is interested in promotion of agricultural implements and tools activities through the HAITI INSTITUTE for Development of Agriculture and Industry (IDAI). The Government of HAITI has requested UNIDO to provide an expert to assist in this activity and to formulate a programme of action.

eee/6

APPENDIX - II

DRAFT PROJECT DATA SHEET

(a) Review the available literature and draft project documents.

(b) Analyse the specific technical aspects of the establishment of an engineering workshop, work out the alternatives on expansion of existing facilities at existing workshop and utilisation of local scrap iron and r material.

(c) Assist selection of location.

(d) Assist in detailing the workshop machinery and equip' ment specifications and prototypes implements to be procured.

(e) Assist in technical main power development through selection of local trainees for fellowships.

(f) Prepare a comprehensive project document on establish' ment of a pilot demonstration engineering workshop, including finances work programme and implementation schedule.

Mechanical Engineer	Expert	2m/m - US.	$.6.000.-
		— $\frac{1}{3}$ m/m =	3.000.-
Reporting Cost.....	.....	=	1.000.-
		US.	[illegible]

.../7

[redacted]

[redacted]

[redacted]

[redacted]

It was recommended that the Governments of developing countries : -

(1) Give Priority in their national plans to, and allocate funds for promoting :

(a) The local manufacture of agricultural machinery and implements, including their design development and testing specifically, hand tools, animal drawn implements, simple hand operated agricultural machines and simple power equipment, since such implements are suitable for manufacture in rural areas;

(b) Maintenance and repair

(c) Extension Services

(2) Hold consultations with the respective resident representatives of the [redacted] in their countries regarding the inclusion of Projects concerned with agricultural machinery in the [redacted] country programming and also explore the possibility of securing funds from the voluntary contributions to [redacted].

(3) Explore the possibility of obtaining assistance from [redacted].

(4) Consider implementing the following projects within the framework of the programme of cooperation among Developing Countries.

.../8

[redacted]

(c) Provide assistance in the field of agricultural machinery in the first instance to project that could

- Benefit the least developed countries
- Promote cooperation among developing countries
- Provide for transfer of technology
- Promote investment.

(d) Initiate project, to be financed from voluntary contributions to establish central machinery workshops and mobile units for maintenance and repair of agricultural machinery at the request of developing countries.

(e) Provide short term experts (put central) under the special Industrial Services Programme to assist in an evaluation of simple agricultural tools that may be procured from various countries to work out engineering adaptation techniques, and to recommend manufacturing potential.

(f) Assist in promoting investment oriented programme and joint ventures that may result from the contacts established between the participants and other developing countries and [redacted] Manufacturers; such assistance might be provided under the programme of cooperation among developing countries.

(g) Make available for technical assistance projects experts drawn largely from developing countries.

cont/

[redacted] X

[redacted]

(Items [redacted] 3202 (S-VI)) [redacted]

[redacted]

IV. [redacted] The least developed, land-locked and island developing countries

Page 28 - 6th. The least developed, land-locked and island developing countries present a set of problems which require special measures if these countries are to attain an acceptable level of economic development. Recalling General Assembly resolutions 3201 (S-VI) and 3202 (S-VI) on the Declaration and Programme of Action on the Establishment of a New International Economic Order, industrialization in these countries must take place at a much more than average - financial outlays and technical assistance from other countries and international organizations are necessary to mobilize a greater volume of resources to make possible the launching of innovative projects in these countries and the laying of a sound basis for the promotion of their industries' which through projects and measures such as :-

Page 29 - (c) The creation of integrated production units such as agricultural machinery plants, appropriate engineering industries and repair and maintenance services.

(d) The implementation of an appropriate agrarian policy as an essential basis for the promotion of integrated rural development schemes involving the establishment of small scale production

.../29

[illegible] to meet both the needs of internal markets and export requirements;

(e) To direct go crafts and cottage industries including artistic crafts;

(f) Assistance for systematic studies of their industrialization potential -

(g) ——— and the speedy establishment of agro-industries with special emphasis on countries affected by drought.

(h) In addition to priority assistance from UNIDO and other international organizations in all fields, additional favourable financial and technical assistance with exemption from counter-part requirements where appropriate should be given to these countries through bilateral and multilateral channels to accelerate their industrialization in conformity with their national policies and development plans.

.../24

[redacted]

[redacted]

(a) [redacted] THE FOLLOWING

(1) Resident Representative UNDP

(2) Mr. [redacted], Industrial Planning Engineer, UNIDO

(3) Mr. Pete NIGHEL IDAI

(4) Officials of Centre for Planning [redacted]

(5) [redacted] BANK OF MALTA

(6) Officials of Ministry of Industry

(7) Officials of Ministry of Agriculture

[redacted] - Mr. Pete NIGHEL

(b) [redacted] paragraph 62 gives importance for UNIDO activities in Least Developed Countries UNDP has also special measures for Least Developed Countries.

(c) [redacted]

(d) [redacted] Pilot Demonstration Manufacturing Plant for agricultural tools, simple implements and hand operated machinery etc...

Together with

Design, Development, Testing, Repair and Maintenance, Training

[redacted]

(e) [redacted] Incorporate other rural products and rural industry with Central Advisory services, common technical service facilities, cooperative marketing facilities and cooperative rural finance facilities.

.../12

7. [redacted] Country programme will start from 1977 - [redacted]. Therefore, a project [redacted] for inclusion in the country programme under IPF Finances.

8. [redacted]

First Month - [redacted] including
- [redacted]
- Agricultural situation
- Industrial situation
- Scope for rural industrialization
- Scope for agricultural tools development and manufacture
- Demand, product specifications possible production volume
- Design and development
- Repair and manufacture
- Analysis and Government policies
- Scope for initiating an integrated project
- Conclusion, recommendations, etc...

Second Month - [redacted] for [redacted] plan to Phase II at a later date (UNIDO "IPF" Country Programme finances)

[redacted] Inputs - Experts $ 4000/m
- Fellowships 1000/m $ 500,000
- Equipment
- Government Inputs

Please discuss with Resident Representative and Mr. Lambert on new Guidelines for preparing project document.

(Discussed the Delhi Clinics draft Project reviewed by Mr. Lambert and Mr. Fritz Michel, adding about [redacted] due to increase in prices. The [redacted] to revised after visits and study local condition. Also [redacted] volume to be estimated.

[redacted] • [redacted] possible for Phase II possible finances from UNDP Voluntary Contributions or UNIDO regular programme budget for this Rural Industrialization Project - (See the attached draft project data sheet for this).

[redacted] • Discuss with Government and Resident Representative Leave a few copies of your Report and Project Document with Resident Representative and relevant Government officials and bring five copies with you to UNIDO.

cc/bl

[redacted]

([redacted])

[redacted]

[redacted]

[redacted]

[redacted] :

(1) • (a) [redacted] : [redacted]

Integrated Rural Industrial Technology
Development and Promotion

(b) [redacted]

(c) [redacted]

(d) [redacted]

(e) [redacted] : •

To assist the Government in formulation of integrated rural industrial technology development and promotion possibly through the establishment of rural pilot demonstration manufacturing units with industrial advisory services and common technical services with emphasis on technology transfer, promotion of appropriate technology and education in rural areas with special reference to training and rural employment and to recommend ways and means of implementation.

(2) [redacted] :

(a) To assist in the utilization of local raw materials and to promote rural employment with special reference to labour intensive but commercially viable rural industries;

.../8

(b) to establish pilot demonstration manufacturing units for appropriate products with emphasis on technology transfer, training of local personnel and extension as well as marketing activities;

(c) to produce on a pilot demonstration basis some products which will have an impact on agriculture, rural industrialization with reference to engineering products, rural construction, industrial processing of local raw materials and to promote design and development potential production capabilities, technology transfer and employment;

(d) to establish a nucleus for training of local artisans, and thus catalyse rural industrialization and local entrepreneurship, which can in turn promote rural industrial activities;

(e) to link rural finance institutions to rural industrialization schemes.

(1) [illegible] : The Expert will undertake an exploratory mission for about three months and carry out the following tasks :-

- Based on the analysis of the Government Plans on rural industrialization, identify specific products that may be taken up for pilot demonstration manufacturing production;

- In consultation with the Government officials identify the local counterpart agency with special reference to rural industrialization;

- Work out the cooperation aspects for project implementation with special reference to finances, manufacture, marketing and overall management;

.../[illegible]

- [redacted]
- [redacted]
- [redacted]
- [redacted]

(c) [redacted]

(a) [redacted]

(b) [redacted]

(ii) [redacted]

(i) [redacted]

(ii) [redacted]

[redacted]

(iii) [redacted]

(iv) [redacted]

(v) [redacted]

(vi) [redacted]

(vii) [redacted]

(viii) [redacted]

(ix) [redacted]

(x) [redacted]

(xi) [redacted]

(xii) [redacted]

(c) [redacted]

- [redacted]
- [redacted]
- [redacted]

(d) [redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]

(a) [redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]

(b) [redacted]

- [redacted]
- [redacted]
- [redacted]

(c) [redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

ANNEXE - VII

DATA ON LAND HOLDINGS IN HAITI

AND ITS ANALYSIS

TABLE - REPARTITION DES UNITES D'EXPLOITATION
en pourcentage du Nombre Total suivant leurs dimensions
et par Departement

(Source Recensement 1950)

(In 1ère Para [illegible] Data 72/56)

% En Hectares	NORD	NORD OUEST	ARTIBONITE	DEPARTEMENTS OUEST	SUD
1 Moins de 0,65	11,0	14,0	12,2	18,7	14,4
2 De 0,65 à 1,30	24,9	26,5	22,1	23,8	25,5
3 De 1,30 à 2,60	34,7	28,9	31,5	28,0	30,2
4 De 2,60 à 3,90	14,9	13,5	16,2	13,5	13,2
5 De 3,90 à 6,50	9,6	9,9	11,5	9,7	9,4
6 Plus de 6,50	4,9	6,4	6,5	5,3	6,3
TOTAL 100	100	100	100	100	100
Nombre Total d'Unités Agricoles	88,000	30,000	117,000	185,000	150,000
TOTAL NUMBER OF ALL THE HOLDINGS COMES TO [illegible]					

...[illegible]

ROUGH ANALYSIS

(Taking round figures)

LAND HOLDINGS ..

(1) Below 0,65 Hectares - average - 15%)
0,65 to 1,30 " " - 25% (TOTAL 70%
1,130 " 2,60 " " - 30% (

GROUP A

SMALL FARMS

can use only manually operated tools and implements
The Total Number of holdings in this group are 406000

(2) 2,60 to 3,90 Hectares - average - 15%) TOTAL 25%
3,90 to 6,50 " - " - 10%)

GROUP B

MEDIUM FARMS

can use both manually operated as well as animal drawn implements and tools.
The total number of holdings in this group are 145000

(3) 6,50 and above - 5%

GROUP C

Comparatively Large Farms, may also use power driven equipment
The total number of holdings in this group are 29000

The Total Number of agricultural holdings in HAITI are about 580,000. Considering the present population as 4500000 and taking that 80% of this population is engaged in agriculture we get a figure of six persons per each agricultural holding.

.../

[illegible]

[illegible]

1) - Finance a) Subscribed capital
b) Paid up capital
c) IDAI'S Loan or Share.

2) - Date of Starting

3) - Partnership or Collaboration

4) - Yearly turnover in quantity
- in money

5) - Home Demand

6) - Area - covered and uncovered

7) - Skilled Labour

8) - Unskilled Labour

9) - Main Machines and equipment with their approximate prices.

10) - Yearly working days and spare capacity
- installed capacity
- (How much can be manufactured).

11) - Safety Measures from the point of view of avoiding accidents.

12) - Diversification if any

13) - Best selling types of Machines and yearly sale.

14) - Special Innovations if any with reasons.

15) - Availability of Raw materials - chaff cutter blades, [illegible] of [illegible], harrows, sickles, shovels, [illegible], boards etc...

16) - Difficulties if any.

17) - Improvisation indicating initiative.

18) - Any exports to nearby countries or imports of machines from nearby countries.

19) - Any other information which you think will be useful.

...../[illegible]

[illegible]

[illegible]
([illegible]) [illegible] ([illegible])

1) - Capital : [illegible]

Paid up already
[illegible] : [illegible]

2) - Started 19[illegible], October

3) - [illegible]

4) - In 19[illegible] : [illegible] tons of [illegible]
Value [illegible]

5) - [illegible]

6) - [illegible] m² covered, and [illegible] m² uncovered

7) - Limited ;

8) - [illegible] Machines & Equipment

10) - [illegible] days yearly working
Capacity : [illegible] tons ([illegible] per day)
[illegible] : [illegible]
[illegible] : [illegible]
[illegible] : [illegible]

[illegible]
[illegible]

11) - Safety for most of the equipment & machineries.

12) - [illegible]
[illegible]

13) - January, February

14) - [illegible]

[illegible]
[illegible]

[illegible] : [illegible]
[illegible] : [illegible]
[illegible] : [illegible]

All [illegible]

[illegible]

.../[illegible]

[illegible]) - [illegible] [illegible] or [illegible], or training of maintenance spare parts and any other difficulties (See § [illegible]).

[illegible]) - Since [illegible], plan was ready, prepared by myself since [illegible], accordingly the [illegible] request (the study document submitted to [illegible] at that time), and each of the equipment (practically all of them) selected as universal for the following reasons :

I - [illegible] must be [illegible] just to avoid complication with [illegible], spare parts [illegible] equipment [illegible]

II - For the later [illegible] of the [illegible] [illegible] (with [illegible] possibility and a great facility for adaptation - [illegible] [illegible] and [illegible]) using the [illegible] possible.

III - [illegible] machines ([illegible] [illegible] [illegible] and installation) only for adaptation and [illegible] of items and [illegible] progress ([illegible] [illegible] - [illegible] [illegible]),

[illegible] [illegible] other reasons shall be explained in favour of [illegible] [illegible] - ([illegible] - [illegible] - [illegible] [illegible])

[illegible] [illegible] [illegible] [illegible] :

[illegible] [illegible] [illegible] [illegible] :

A : [illegible] [illegible] [illegible] [illegible], [illegible] [illegible] [illegible] type of [illegible] [illegible] [illegible] - [illegible] different [illegible] ([illegible]),

B : [illegible] [illegible] [illegible] - [illegible] [illegible] [illegible], [illegible]

1° - [illegible] [illegible] [illegible] of [illegible] [illegible] [illegible] by the [illegible] of [illegible], [illegible] [illegible] [illegible] - [illegible]...

2° - [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] - [illegible] [illegible] [illegible] ([illegible] - [illegible]) [illegible] [illegible] electric [illegible] - [illegible] [illegible] [illegible] [illegible]

([illegible]) [illegible] for different [illegible] : [illegible] [illegible] [illegible] and [illegible] of the [illegible] [illegible] : [illegible] [illegible] [illegible] - [illegible] of [illegible]) [illegible] [illegible] [illegible]).

C : [illegible] [illegible] : [illegible] [illegible] [illegible] and [illegible] - [illegible] [illegible] [illegible] [illegible] - [illegible] [illegible] [illegible], [illegible].

[illegible] [illegible] [illegible]([illegible]) [illegible] [illegible] [illegible] [illegible] - [illegible].

[illegible]/[illegible]

8 : [illegible] : [illegible] to cut by hand size of 1/4" x any length, [illegible] or [illegible].
[illegible] : 1/4" or 3/16" x 4"
Capacity : several tons per day of 8 hours.

8 : [illegible] to the [illegible] - rolling - [illegible]
installation -
[illegible] built in - [illegible]
Built by myself - Available to straight, or form shaping
1/2 circle - for several 100Kg/day.

9 : [illegible] shop - 1) including [illegible]
[illegible] a [illegible].
2) [illegible] heavy duty [illegible] machine,
3) [illegible] machine,
4) [illegible] circular saw,
5) Multiple spindle drill [illegible].

(These equipments are in very good condition, [illegible]) are available for [illegible] up [illegible] thickness - any length.

[illegible] - [illegible] to [illegible] - ([illegible] - [illegible] available [illegible]).

107 - We received several request for [illegible] - [illegible] export to [illegible] - [illegible]. Quality and price are [illegible]. [illegible] for local [illegible] [illegible] imported [illegible] from [illegible] [illegible] of [illegible] because of [illegible] [illegible] built [illegible] for [illegible] they [illegible] [illegible] [illegible] [illegible] the [illegible] [illegible] to [illegible] we [illegible] to build [illegible] [illegible] for export.

108 [illegible] good possibility this year [illegible] local [illegible], [illegible] by [illegible] for raw material [illegible] [illegible] for [illegible] [illegible] will be sufficient, [illegible] the [illegible] material [illegible] [illegible] but [illegible] required [illegible] in [illegible] of raw material.

109 - [illegible] : [illegible] by [illegible] - [illegible] ([illegible] x [illegible]) [illegible] available - [illegible] circle - [illegible] raw material [illegible] for [illegible] - [illegible] by [illegible] several - [illegible] - [illegible] subject - Prototype [illegible] of [illegible]

110 - [illegible] x [illegible] [illegible] by [illegible] - [illegible] - [illegible] [illegible]
The [illegible] will be [illegible] - [illegible]

.../[illegible]

[illegible] [illegible]

[illegible] [illegible]

[illegible]

[redacted]

[redacted]

[redacted]

[redacted]

Is : 7[illegible] - 1[illegible]	Glossary of terms relating to farm implements and machinery.
Is : 7[illegible] - 1[illegible]	Method of sampling of agricultural machinery and products.

[redacted]

Is : 1[illegible] - 1[illegible]	Rotary paddy weeder (first revision)
Is : 2[illegible] - 1[illegible]	Mould board plough, turnover type, animal drawn.
Is : 2[illegible] - 1[illegible]	Mould board plough, fixed type, animal drawn.
Is : 2[illegible] - 1[illegible]	Blade harrow, furrow type.
Is : 2[illegible] - 1[illegible]	Ridger, animal drawn
Is : 3[illegible] - 1[illegible]	'V' Blade hand hoe
Is : 3[illegible] - 1[illegible]	Three tined hand hoe, fixed type
Is : 3[illegible] - 1[illegible]	Levelling blades (ELBs), animal drawn.
Is : 3[illegible] - 1[illegible]	Crop cutter trough, animal drawn.
Is : 3[illegible] - 1[illegible]	[illegible] (three-tined cultivator) animal drawn
Is : 3[illegible] - 1[illegible]	Dibbling hoe
Is : 3[illegible] - 1[illegible]	Harrow [illegible] (levelling)
Is : 3[illegible] - 1[illegible]	Puddler, animal drawn.
Is : 3[illegible] - 1[illegible]	Seed furrower.
Is : 3[illegible] - 1[illegible]	Khurpi hand hoe.
Is : 3[illegible] - 1[illegible]	Disc harrow, animal drawn (first revision)
Is : 4[illegible] (Part I) - 1[illegible]	Agricultural tillage chisel - Part I - shovel type (first revision)
Is : 4[illegible] (Part II)- 1[illegible]	Agricultural tillage chisel - Part II Plat type (first revision)
Is : 6[illegible] - 1[illegible]	Harrow-hitch chain I
Is : 6[illegible] - 1[illegible]	Foot rods for mould board plough
Is : 6[illegible] - 1[illegible]	Disc ring animal drawn mould board plough shares
Is : 6[illegible] - 1[illegible]	Clamp
Is : 6[illegible] - 1[illegible]	Tapering animal drawn mould board plough shares
Is : 6[illegible] - 1[illegible]	Tractor operated disc harrows
Is : 6[illegible] - 1[illegible]	Spring loaded tractor mounted cultivators.

IS : [illegible] - [illegible] Blade for rotavators

IS : [illegible] - 1974 Plate spool for tractor drawn disc harrow

IS : [illegible] - 1974 Plate spool for animal drawn disc harrows

IS : [illegible] - 1974 Blade for tractor harrows

IS : [illegible] - 1974 Tines for animal drawn cultivators

[redacted]

IS : [illegible] - [illegible] Single row cotton seed-drill animal drawn

IS : [illegible] - [illegible] Three tined cultivator with seeding attachment, animal drawn

IS : [illegible] - [illegible] Foot [illegible] for seed cum fertilizer drill

IS : [illegible] - [illegible] Seed cum fertilizer drills

IS : [illegible] (Part I) - [illegible] Fluted feed roller type seed metering mechanism, Part I - seed feed rollers

IS : [illegible] (Part II) [illegible] Fluted feed roller type seed metering mechanism, Part II seed feed cut-off

IS : [illegible] (Part III) [illegible] Fluted feed roller type seed metering mechanism, Part III, Retaining ring and cover

IS : [illegible] (Part IV) [illegible] Fluted feed roller type seed metering mechanism, Part IV seed feed cups

IS : [illegible] (Part I) [illegible] Plate type seed metering mechanism - Part I - seed plates

IS : [illegible] (Part II) [illegible] Plate type seed metering mechanism, Part II - seed feed roller

[redacted]

IS : [illegible] - [illegible] Hand compression sprayer (second revision)

IS : [illegible] - [illegible] Single barrel [illegible] pump (second revision)

IS : [illegible] - [illegible] Hand rotary duster shoulder mounted type

IS : [illegible] - [illegible] [illegible] pump for pressure retaining knapsack sprayer

IS : [illegible] - [illegible] Pressure retaining knapsack sprayer (first revision)

IS : [illegible] - [illegible] Rocker sprayer (first revision)

IS : [illegible] - [illegible] Dust applicator for [illegible]

IS : [illegible] - [illegible] Foot sprayer (first revision)

IS : [illegible] - [illegible] Sprayer, [illegible] type, hand operated (first revision)

IS : [illegible] (Part I) - [illegible] Continuous sprayer, knapsack type part I - piston type (first revision) with [illegible]

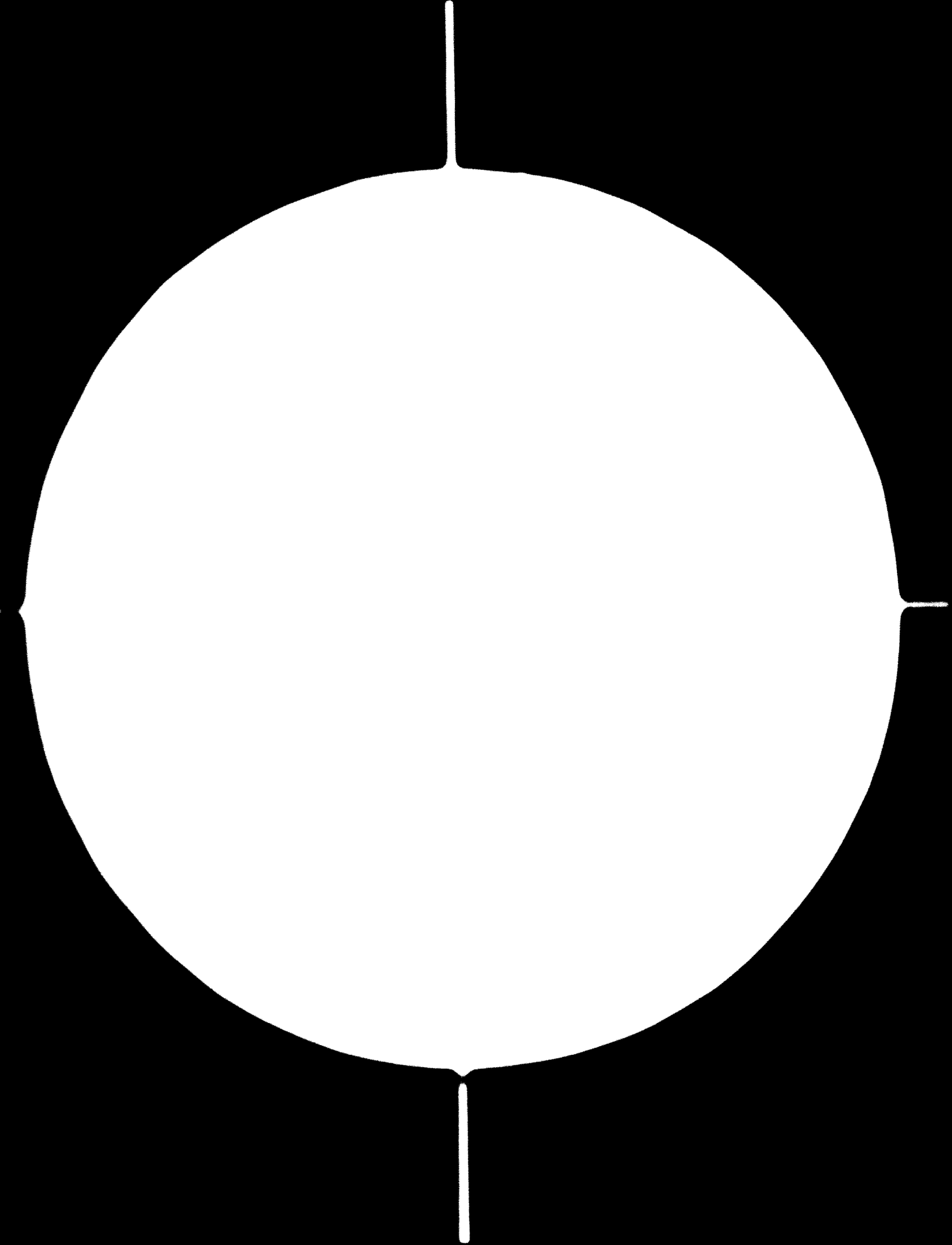
IS : [illegible] (Part II) [illegible] Continuous sprayer, knapsack type Part II - Diaphragm type

IS : [illegible] - [illegible] Hand rotary duster belly mounted type

IS : [illegible] (Part I) [illegible] Hydraulic spray nozzles (Part I) flat fan and cone type

C-662

81.12.03



[redacted]

Is : 5120 - 1968	Technical requirements for roto dynamic special purpose pump
Is : 6595 - 1972	Horizontal centrifugal pumps for clear, cold, fresh water for agricultural purposes

[redacted]

Is : 3153 - 1965	Thresher, clpad type
Is : 3387 - 1965	Paddy thresher pedal operated
Is : 4398 - 1967	Sickler (Serpettes)
Is : 6084 - 1970	Guards for grain harvesting machines
Is : 6085 - 1970	Knife sections for grain harvesting machines
Is : 6864 - 1971	Test code for stationary power thresher forwheat
Is : 6320 - 1971	Wheat power thresher (hammer mill type)

[redacted]

Is : 1511 - 1968	Light duty chaffcutter blades (first revision)
Is : 1973 - 1973	Sugarcane crushers (first revision)
Is : 3939 - 1967	Hand Maize Sheller
Is : 4930 - 1968	Guide for axle assembly for animal drawn vehicles
Is : 5718 - 1970	Test code for air-screen seed cleaners.
Is : 6997 - 1973	Test code for sugarcane crushers
Is : 7051 - 1973	Power Maize shellers
Is : 7072 - 1973	Test code for power maize shellers

[redacted]

Is : 619 - 1968	Pruning knives, hooked and curved (revised)
Is : 681 - 1957	Forks for plantations and estates
Is : 2838 - 1962	Transplanting spade and [redacted]
Is : 3899 - 1963	Garden axes
Is : 3963 - 1963	Hedge shears, straight edge type
Is : 3992 - 1965	Rubber draining and tapping knife
Is : 3993 - 1965	Bill Jungle cutting knife
Is : 3994 - 1965	Bill-hook
Is : 3998 - 1965	Pruning saw, straight and curved
Is : 3999 - 1965	Budding and grafting knife, combined
Is : 4004 - 1966	Pruning secateur

APPENDIX No. X

POIS CHICHE - CICER ARIENTINUM

Encyclopédie Biologique - Les plantes alimentaires, part I, by D. BOIS , page 97, published by Paul LECHEVALIER, Paris

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Le genre Cicer comprend sept espèces de la région méditerranéenne et occidentale. L'une d'entre elles, le c.arientinum Linné (fig.47) est une plante alimentaire très cultivée, bien connue sous les noms de Pois chiche, Pois cornu Anglais. Le Garbanzos c'est le chick Pea des Espagnols. Elle porte le nom de Horse Gram dans l'Inde

D'après de Candolle (l'origine des plantes cultivées); elle n'a jamais été trouvée d'une manière certaine dans les conditions d'une plante spontanée. Toutes les flores du midi de l'Europe et de l'Asie Occidentale en parlent comme d'une espèce cultivée ou de terrains en friche. Toutes les autres espèces de Cicer (sauf une de l'Abyssinie) étant de l'Asie Occidentale ou de la Grèce. La probabilité serait donc, d'après lui, que l'espèce cultivée vient des pays situés entre la Grèce et l'Himmalaya, appelés vaguement : l'Orient.

Les Grecs cultivaient le Pois Chiche dès le temps d'Homère, sous les noms d'Erebintnos et de Krios à cause de la ressemblance de la graine avec une tête de bélier. Les Latins l'appelaient Cicer. On suppose que les anciens Egyptiens l'ont connu car il était déjà très cultivé en Egypte dès les premiers temps de l'ère chrétienne.

L'introduction a été plus ancienne dans l'Inde, car on connait un nom sanscrit et plusieurs noms analogues ou différents dans les langues modernes.

Aucune preuve n'existe de l'ancienneté de sa culture en Espagne. Cependant, dit de Candolle, le nom castillan Garbanzo n'étant ni latin, ni arabe, peut remonter à une époque plus ancienne que la conquête romaine.

Le Cicer arientinum est une plante annuelle de 30 à 50 centimètres de hauteur, velue glanduleuse, sans vrilles, à feuilles inparipennées à 6-8 paires de folioles ovales dentées, à stipules lancéolées et dentées. Les fleurs, blanches ou bleuâtres, sont solitaires sur des pédoncules axillaires plus courtes que la feuille; elles sont petites, à corolle dépassant à peine le calice. Le fruit est

une gousse très renflée ovoïde, terminée en bec, contenant 2 grains ovoïdes -cornigues ridées, ayant l'aspect d'une tête de bélier flanquée de ses cornes enroulées. On en connait plusieurs variétés qui diffèrent par les dimensions de la graine, grosse, moyenne ou petite, et dont la couleur peut être blanc jaunâtre, rougeâtre ou noire.

C'est l'une des Légumineuses qui résistent le mieux à la sécheresse et sa production est assez grande. On la cultive surtout dans les régions subtropicales : dans l'Inde, en Algérie où sa graine constitue une ressource précieuse pour les Kabyles et les Arabes. C'est un aliment très riche, mais indigeste. D'après Alquier, il contiendrait 86,48% d'unités nutritives : 15,15 de matières azotées; 4,52 de matières grasses et 59,90 d'hydrates de carbone.

Les Pois Chiches se mangent bouillis et assaisonnés avec de l'huile et du vinaigre et aussi en purée.

APPENDIX - XV

A STUDY OF

AGRICULTURAL AND INDUSTRIAL SITUATION

IN HAITI.-

To get to know the country it is necessary to read about it from various sources, collect the information and wherever possible visit the areas and actually observe the situation. This is particularly true in case of HAITI because there are no statistical data available at present in the required details and one has to depend largely on reports of others and by gathering information by discussion. The visits further confirm the observations. In the following pages such information has been gathered from whatever source is possible in the limited time that was available. A Bibliography has been given in Appendix XVI. The information collected is by no means original but it is useful for making study of agriculture and industry.

Important places of interest to Agricultural and Industrial Development such as Agricultural Farms, Institutes, Factories, Worshops, Sales Agencies, Repair Shops etc... visited during these 2 months have been shown in a rough map of HAITI (Figure No. 54).

In making these studies the following items were particularly looked for : -

(A) GENERAL - Location of the country, surroundings, Population- Principle imports and exports education etc...

(B) AGRICULTURAL SITUATION -

- Topography, Soil Types, Soil Profiles, Ph Value, Organic Matter -
- Rainfall, Temperature, Sunshine hours, Wind Velocity, Evaporation data, Seepage data, Flow in rivers and streams, Irrigation, Drainage, Water table data.
- Main Varieties of crops, Their methods of cultivation, main operations, Botanical names of crops, yields per hectare, Prices of crops, sawing and weeding methods, Harvesting Threshing Winnowing, Transport Storage, Processing, Plant Protection Fertilisers, Manures, Garden and Horticultural tools.
- Training and extension.

.../26

(c) [redacted]

- Manufacture, Raw Materials, Designs Factory Regulations and acts, Wages, Patent Laws and Registration of Trade - Marks, Standardisation
- Spare parts availability, mobile workshops, Repair and Maintenance -
- Training and Extension,
- Household or domestic appliances, Utilisation of fuel, Construction of houses and food stores - Grinders,
- Rural Industries and their tools
- POWER AVAILABLE - Wind power, Water power - Solar energy - Man power, animal power, Diesel engines, electric power, mini-hydro electric plants, prices of diesel and gasoline etc...
- Credit available - cooperatives etc...

The information on above points was sought. It has not been possible to get information on all points yet whatever has been obtained is given in extract form in the followint pages and some data has been included in the main report Whatever such infosm' ation has been collected by referring to reports or by observation during tours and visits has been useful in formulating the recommend' ations given in this report.

.../27

(A) GENERAL INFORMATION:-

The Republic of HAITI occupies the Western third of the Island formerly known as Hispaniola, it is bordered by the Atlantic Ocean on the North and by the Caribbean Sea on the West and South and has a common frontier with the Dominican Republic on the East. Its surface area is 27,700 Km² (is mostly mountainous) The climate is tropical and moderate.

The population was estimated at approximately 4,500,000 in 1971. The annual demographic growth rate is 2 per cent and the average population density is 175 persons per K m² - The cultivable areas are over populated (530 persons per K m²) and 80 per cent of the population is concentrated in the countryside. There are approximately 450,000 persons in the capital, Port-au-Prince, HAITI's population is extremely young, 42% being under 14 years of age. The level of school attendance, 17 per cent is the lowest in Latin America. The level of literacy is 10%.

The growth rate during the 10 - year period 1961-1971 was only 1 per cent per year, at constant prices, owing to the stagnation of agriculture. The economic improvements of recent years has not prevented per capita product from continuing to decline 97$ in 1971 and being the lowest on the South American Continent and one of the lowest in the world.

The principal exports are : -

(1)	Coffee -	$.18.8 Million
(2)	Re-export of manufactured Goods assembled in HAITI	$..8.1 "
(3)	Bauxite	"..6.5 "
(4)	Sugar	"..3.8 "
(5)	Essential Oils	"..3.1

out of overall Total of ...$....462 Million in 1971. The same year, imports amounted to ... $.58.1 Million .

"The Government strongly hopes that UNDP will be able to increase the IPF for HAITI in view of its classification as one of the twenty five Least Developed Countries of the world, in order to ensure the financing of these priority projects."

.../38

(B) - AGRICULTURAL SITUATION

COUNTRY AND INTERCOUNTRY PROGRAMMING

HAITI...

(UNDP assistance requested by the Government of HAITI for the period 1973 - 1977 - UNDP No-DP/GC/HAI/R1

11, Décembre 1972, English

" B- OBJECTIVES AND PRIORITIES OF THE FIRST FIVE-YEAR PLAN, 1972-1976.

8. HAITI has always been and still is an essentially agricultural country. For some years the national economy has been gradually emerg' ing from the state of stagnation which had characterised it in 1960's, but the Government is still faced with serious difficulties, such as inflation, trade imbalance, budget deficit, increasing under employ' ment, housing shortage, on flow of private savings, out dated marketing structures and methods, the rural exodus, a lack of trained professional staff at all levels, regressive income distribution and so on. The industrial sector is still very under-developed and imported essential consumer goods account for 40 per cent of total imports whereas most of them could be produced and manufactured locally - (Edible oils, cheeses, milk, meat and fish, preserved foods etc...).

9. The Government is contributing increasingly to investment: Almost 80 per cent of Government Investments are devoted to the infrastructure, including the Peligre Hydroelectric power station, the Port-au-Prince airport, the road to the south (30 km concrete paved) and improvement of Port-au-Prince wharf. Funds for the directly productive sectors are therefore minimal. Agricultural Development Programmes are financed mainly by means of external assistance and programmes in the industrial sectors are left in the hands of private, and for the most part foreign investors. However with the assistance of the Inter-American Development Bank (IBD), The Institute for Agricultural and Industrial Development (IDAI) has started to establish an industrial park at Port-au-Prince.

10 - Under the five year plan, the bulk of public investments, will in the next five years, be concentrated in the following areas: transport (26,1 per cent) agriculture (26.9 per cent), Power (13 per cent), health and environment (6.3 per cent), industry (5.5 per cent), Tourism (4.9 per cent), only 2.7 per cent will be allocated to education. It must be emphasised that although national and foreign resources will contribute in almost equal shares to investment in the main economic sectors, in the social sectors two thirds of the re - sources will have to come from outside. Lastly it is envisaged that 6.8 per cent of public investments will be allocated to technological research and to 30 pre-investment projects.

.../

II.- THE PLAN HIGHLIGHTS THE FOLLOWING PRIORITY AREAS : -

AGRICULTURAL SECTOR : - The Government has decided to adopt a new strategy aimed at winning the population/production race on the following fronts :

(i) Increased production of food stuffs of animal and vegetable origin for the domestic market and export of surpluses (maise, beans, bananas, rice, pigeon peas, meat);

(ii) Increased volume of exports of coffee, sugar, cocoa;

(iii) Strenthening of the agricultural infrastructure through the construction and restoration of irrigation systems;

(iV) Campaign against soil erosion by means of a long term reafforestation programme, terracing and regulation of rivers;

(V) Promotion of maritime and fresh water fishing and of stock-raising;

(Vi) Training of agricultural technical personnel at all levels;

.../

AGRICULTURAL PRACTICES

SUGAR CANE - Three to four ratoons (repousses) of cane are usually taken. The plant cane is cut at 15 to 18 months.

The cane is generally interplanted with food crops in the 181 year. For this purpose the cane is not close planted in raws but the seed pieces are planted singly and irregular' ly at wide spacing. As a result, the average small cane plot consists of a number of isolated cane stools.

The planting procedure described a ove has two very grave disadvantages. Firstly the plant population is far too small to give a reasonable yield per hectare. Secondly the cane stool grows in isolation. It continues to tiler whenever moisture conditions permit and the result is a stool consisting of young sheet, immature stalks, mature stalks, average stalks and dead stalks. Apart from the reduotion in the yield therefore, this planting procedure tends to produce cane of poor quality. It also partially defeats its purpose of providing subsistence crops in addition to cane, as the space between the cane stools is wasted during the years the cane is ratooned. A far more rational procedure than their cropping would be rotation of cane with food crop growing a cycle of cane at macimum yield and then taking a food crop from the whole area before replanting to cane

Yields are 46 to 49 tons per hectare.

These yields are extremely lowly the standards of nearly all the other cane growing countries and are the result of manuy factors mainly insufficient planting density, inadequate water, deficient drainage, lack of fertiliser, and poor varieties. With a normal plant population, good drainage, adqequate nutrition and a suitable modern variety, one would expect an irrigated yield per hectare of the order of the tons and a rainfed yield varying from about 88 tons at LEOGANE to 91 at CAYES and 95 in the PLAINE DU NORD.

SORGHUM is planted on hill slopes by digging by machete or hoe. After the earheads are cut, the stalk is allowed to remain on the ground and removed before next ploughing.

BEANS - are planted on sides of small ridges.

PADDY - pudding is done by hoe, and the weeds are then removed. The seedings are then transplanted. Harvesting is done by human labour by hand picking the ear-heads. The stalk is allowed to stay on the Land.

CORN - planting and harvesting is like SORGHUM. In both cases there is no line sawing even on level lands. Therefore, all weeding has to be done by hand labour.

.../

SOILS

Cane is mainly grown on alluvial soils. The soils of the alluvial plains and valleys are well suited to the production of cane. The fact that they have been continuously cropped for several hundred years since colonial times without fertilisers attests to their excellence.

The soils of HAITI are generally derived from the weathering of mountainous mass of Limestone rock. There are only minor outcrops of volcanic rock. Approximately 80% of the country is steeply mountainous and soil over this area is thin with frequent out crops of line stone. When tilled these soils are subject to rapid loss of productivity through erosion and depleti n.

The alluvial soils of the plains and at the bottom of the mountain valleys are mostly dark gray to black clayey loan. In the upper reaches the narrow valleys are filled with small boulders and gravel washed down from steep slopes. In the lower areas, as in the Artibonite, the alluvial soils are brown to gray with a very light subsoil. (Does hard pan happened)

In the dry plains most of the soils tend to be all alive.

.../

RAINFALL

TEN YEARS RAINFALL 1965 - 74 IN

MILLIMETRES

COMPILED FROM FIGURES OF THE SERVICE METEOROLOGIQUE NATIONAL - DARNDR..DAMIEN

(1)	Cul-de-Sac (DAMIEN)	- Mean - 948	WETTEST- 1188	DRIEST- 795
(2)	Léogane	Mean -1367	" - 1645	" 1100
(3)	Cayes	" 1635	" - 2707	" 1006
(4)	Cap-Haitien Plaine du Nord Coast	1377	" - 2067	" 1022
(5)	Grande Rivière du Nord (Plaine du Nord, inland)	1531	" - 1804	" 1033

- The number of years Mean equals or exceeds is between 3 to 6
- No records of evaporation are available.
- There are normally two rainy periods a relatively short peak in May and the main wet season in autumn with the peak around September.

While the annual rainfall is adequate on an average, The rugged topography of the country causes an apparently capricious distribution of the rain and hence the vegetation. The mountain system presents altitudes up to 8,790 feet with a great diversity of relief producing on one hand areas of unusually high rainfall and low evaporation and on the other, areas where conditions are reverse.

../

IRRIGATION AND DRAINAGE

Irrigation of cane is generally practiced only in the plaine de Cul-de-Sac, and in very limited area in the plaine du Nord.

In Cul-de-Sac - 8,000 to 9,000 hectares of farmers cane irrigated from public water supply and around 3000 hectares of HASCO cane irrigated from Company owned wells. The cost of pumping is excessive. Gravity irrigation ley furrow is practiced at Cul-de-Sac.

In plaine du Nord the ground water is thought to be generally available and water table is high in many parts of the plaine.

The drainage is a problem in all the alluvial plaine as the water table is generally high and the rivers are liable to overflow their banks after heavy rains.

.../

The Rivers in HAITI are short, with great irregularity of flow during the dry season, while during the rainy season it becomes a large and extremely dangerous torrent which has many times caused destruction and loss of life over a wide area. Small streams frequently dry up altogether in dry season, but are a menace to habitation and an obstacle to transport during the rains. The porosity of the Lime stone formations characterising most of the surface geology of HAITI has prevented the formation of natural reservoirs in high country and consequently run off is extremely rapid, but the same conditions favour underground conditions of water, which appears to be considerable in volume. The rapidity of run off has been aggravated by deforestation and consequent denudation of mountain areas.

.../

LAND TENURE

During the colonial period the plantation system was followed. During the wars of liberati n and independence this pattern of production was abolished to be succeeded by a subdivision of the land into individual holdings. The result today in agriculture shows a pattern of production characterised principally by a large number of very small individual holdings dedicated primarily to the production of family subsistence..... The fact that subdivision of the land has taken place without a consistent survey and registration of titles contributes to a general feeling of insecurity of ownership in agriculture, which affects producers, distributors, administrators at all levels and which constitutes the principal obstacle to agricultural develop' ment in the country. The haitian peasants wish is to own his land in freehold, and only thus does he feel secure. Litigation over land is a constant pre-occupation of the peasant.

The Land is cultivated by hoe or a machete. No fertiliser is added. The forest cover is cut for fuel and farming. The absent layer of fertile soil is thus exposed to rains. This destruction of the cover of the slopes and tops of the great mountain area of HAITI has reduced the country's valuable timber resources decreased its coffee production areas, poured the silt from the eroding bare soils into irrigation systems, stream beds and lakes in the valleys thus increasing flood damage and render' ing the valley land less improductive.

There are about 580,000 agricultural holdings in HAITI (1972). The population of HAITI is 4500000 out of which. It is estimated that about 80% is engaged in agriculture. Therefore 3600000 people cultivate - 580,000 agricultural holdings. This brings 6 persons per agricultural holding which is between 0.65 to 6.50 hectares mostly and a family of 6 (husband, wife and 4 children have to subsist of such small farms under precarious rainfall conditions.

The distribution of farm holdings location wise is given below

(DEPARTMENT)

(1)	NORD	... .	98,000
(2)	NORD-OUEST	.....	30,000
(3)	ARTIBONITE	.....	117,000
(4)	OUEST	.....	185,000
(5)	SUD	.....	150,000
	TOTAL	.....	580,000

.../

EXTENSION

DARNDR has a Service de Vulgarisation, but its agents are insufficient in number (1 to 5000 Rural families), deficient in training (two -thirds are only of primary education level) and do not have the budgetary or transport facilities necessary for effective agricultural extension work. The principal function of the district extension agent is to help farmers with the preparation of loan applications to BCA.

The sugar factories do not have extension staff and very little technical aid to cane farmers.

For practical purposes, it may be said that there is no extension or demonstrative work for the improvement of cane farming.

The same applies to owner farming and preliminary extension work will have to be done by the suggested personnel of the project suggested. One demonstrator is, therefore, provided in the scheme.

CREDIT

The BANQUE NATIONALE DE LA REPUBLIQUE DE HAITI (BNRH) is believed to have loaned funds with the sugar factories other than HASCO.

IDAI is a source of credit to planters, but has not so far, made loans to cane-farmers. In 1973 a total of $.7,548,702 was advanced to 18,431 planters mainly of cotton and maise. In 1974 the comparable figures were $.9,057,706 to 20,553 planters and in 1975 mainly of cotton maise and haricots. Interest is 12%.

IDAI would be likely to provide credit if it were thought desirable for the semi-artisanal industries based on cane to be assisted to improve their efficiency.

BCA has very limited funds, which used chiefly to provide credit for the producers of food crops.

- THE SUGAR COMPANIES, unlike common practice elsewhere, do not finance their cane farmers, except in regard to a limited amount of mechanical cultivation, the cost of which is recovered from the payments due for cane. In general, the credit conditions for farmers are difficult as the property title is usually required as security.

.../

STANDARDISATION ...

There is no agency for standardisation in HAITI nor for granting of patent rights but it is understood that granting of Registered Trade Marks is done by the Government.

— TRAINING

General agricultural training is provided by DARNDR at three levels. Elementary training is given in vocational schools, producing extension agents of primary education standard. Inter - mediate training for two years to the level of agricultural ins ' tructor is given at three "Ecoles Normales" and the Ecole Moyenne d'Agriculture at DAMIEN. Higher education leading to qualification as "ingenieur agronome is provided at the Institut Agronomique DAMIEN.

— Facilities exist for local training of engineers and agronomists, but without specialisation. Sugar expertise would best be provided by a period of post-graduate study in a suitable sugar producing country. OAS has agreed to provide funds for such training in respect of a limited number of HAITIAN graduats to be engaged by IDAI.

Any general improvement in the Haitian sugar Industry will be possible only by long-term and sustained effort. This can be effected only by adequately trained, permanent Haitian Technical Staff, support' ed as may be necessary by foreign consultants : intermittent visits by overseas experts cannot alone have any lasting effect. Training of Haitian Technical Staff must, therefore, be a first priority in any scheme for increased pfoduction and efficiency in sugar industry as a whole.

.../

ADMINISTRATION

INSTITUTIONS

The Department de l'Agriculture, des Ressources Naturelles et du Développement Rural (DARNDR) consists of several divisions. The division de Recherche Agricole has already been mentioned. The Division de l'Agriculture deals with extension and cooperatives and also supervises the Bureau de Credit Agricole (BCA). The Division des Ressources Naturelles is responsible for drainage and irrigation through the Service d'Irrigation. The Depart' ment is also concerned with agricultural instruction in primary schools, The Ecole Moyenne d'Agriculture de DAMIEN and the Institut Agronomique de DAMIEN where"Ingénieurs-Agronomes" are trained.

The INSTITUT DE DEVELOPPEMENT AGRICOLE ET INDUSTRIEL (IDAI) is an autonomous financial body established in 1961 with funds lent by IDB

(Additional details of IDAI are given in paragraph No...)

The Division de CREDIT and the Division d'Assistance Technique et Développement a number of separate services, including the Service Etudes et Réalisations de Projets Industriels (SERPI)

The programme des NATIONS UNIES pour le Développement (PNUD) and the Organisation des ETATS AMERICAINS (OEA) both maintain offices in Port-au-Prince.

.../

SUBSIDY...

At present there is no subsidy granted to the farmers. At least in the initial stages 10% subsidy on pruchase of implements is suggested.

In Mr. Luico-Smiths' Report also he has mentioned some fiscal measures as follows : -

a) Lowering of the tax on guildives using molasses

b) Remission of the excise tax on gas-oil used for pumping irrigation water. Any loss of revenue would be more than compensated by increased cane and sugar production. In view of vital necessity of irrigation in Cul-de-Sac a subsidy might even be considered.

.../

INDUSTRIAL SITUATION

B - OBJECTIVES AND PRIORITIES OF THE FIRST FIVE - YEAR PLAN, 1972 - 1976

II. THE PLAN HIGHLIGHTS THE FOLLOWING PRIORITY AREAS : -

INDUSTRIAL SECTOR : Systematic inventory of mineral wealth, encouragements to industrialists using agricultural commodities (Sisal, coconut, cotton, ground nut, sesame and sunflower). The rapid industrial development of recent years has encouraged the Government to grant many institutional facilities and financial incentives to foreign investors (duty-free imports of capital goods and materials for the production or assembly of goods to be exported free of duty, income tax exemption, etc...).

SOCIAL SECTOR : - Water supplies for built up areas, rain water control in metropolitan area; control of communicable diseases (yaws, malaria, tuberculosis, tetanus neonatorum), campaign against infant malnutrition which affects 60 to 70 per cent of children aged from one to four years; development of community action.

2 - INDUSTRY, TRADE AND TOURISM

(a) INDUSTRY

25 - The objectives of the industrial policy set forth in the five-year plan are as follows :

- To reach a constant growth rate in industrial production of 10 per cent per year;
- To meet domestic requirements for industrial goods as far as possible by means of advantageous tax measures to encourage production;

.../

- To increase exports of manufactured goods (88 million gourdes in 1970 or 44 per cent of total exports which included 42 million gourdes of processed goods);

- To absorbe the increasing labour resources;

- To expand industrial processing of local raw materials for export;

- To promote industrialisation in the provinces;

26 - The objective is reduce imports of manufactured goods in 1976 by 25 % per cent in comparison with 1972. The priority sectors for the domestic market are : textiles, food products, and goods produced by light industries; for the export market assembly industries and agro-industrials products. Industry's share of GDP should increase from 11-2 per cent in 1970 - 71 to 12.4 per cent in 1975-76. Public Investment has been set at 40 million gourdes (75 per cent of which will be provided by foreigh resources); it is only fifth in the priorities awarded to different sectors with 5.5 per cent of total invest' ment during the period 1972-1976.

27 - The Government had hoped to receive technical assistance in the industrial field, particularly in industrial planning mainly because small scale industry (87 per cent of enterprises are family businesses and employ fewer than eight persons) and the agro - industrial sector are developing very rapidly especially at Port-au-Prince. Because of low indicative planning figures, this project could not be included in the programme for 1973-1977.

.../

28. - UNIDO, under its special Industrial Services (SIS) programmes has undertaken a project on industrial park and duty free zones (HAI/71/009) which UNDP has undertaken to finance for one year from June 1972. It is to be extended until July 1974 - The expert at present in the field is helping to build an industrial park at Port-au-Prince covering 25 hectares, with the necessary infrastructure, and to organise it as a duty free zone; the total area may be increased to 158 hectares. The expert's assistance in this project is deemed indispensable, since construction of the industrial park in the capital city has already been greatly delayed because of administrative problems.

(b) - TRADE - There have been very encouraging trends in foreign trade over the last-three years, particularly in re-exported products, but the proportion of importscovered by exports remains small (78.4 per cent in 1971) and must be improved soon for it has been declining since 1968. In towage, the unbalance between imports and export is even more pronounced because exports (primary products) are three times less valuable per ton than imports (mainly manufactured and semi-manufactured goods) HAITI'S main trading partner is the UNITED STATES whose market takes approximately 50 per cent of its exports . HAITI is completely dependent on foreigh shipping lines for its foreign trade.

30 - An FAO specialist in marketing agricultural products has been working on the North-West Project (HAI/62/503) -

He is making a study of potential markets in the CARIBBEAN area and in the UNITED STATES of AMERICA for all HAITI'S agricultural products. Recommendations could be of immediate use in orienting agricultural production.

APPENDIX XII

Advice given to IDAI on two items:

(a) Mr. Celestin's Foundry Project

(b) Credit Project by Mr. Gibbs

(a) COMMENTS ON Mr. CELESTIN'S FOUNDRY PROJECT AT CAP-HAITIEN

I have gone through the information submitted by Mr. Isaac Célestin and also visited his workshops at Cap-Haitien and Madeline along with Mr. Fritz Michel of IDAI. My comments on the proposed project are:

1) Mr. Célestin has adequate practical knowledge about foundry operation - because of shortage of electric power at Cap-Haitien he has abondoned the Electric cupola and has instal led a coke operated cupola at Madeline. He needs assistance in building a shed and for purchase of raw materials.

2) He has already collected assorted scrape iron mostly from old automobiles. At Cap-Haitien he has a small workshop with old lathes, drilling machine, grinding machine, electric welding set, etc. The quality of the wooden patterns he has prepared for being used in preparing moulds are very good. He is already manufacturing parts of bullock driven sugar cane crushers on the pattern of KIRLOSKAR (INDIA) make crushers.

3) He is desirous of manufacturing sugarcane crushers, maize shellers and ploughs. At present he does miscellaneous automobile and general manufacturing jobs.

4) He has initiative and experience in foundry operations and if assisted by IDAI would do well helping the farming community around.

5) The Loan may be given by IDAI after considering imposition of the following conditions essential for the success of the project.

a) That the design of the bullock driven sugarcane crusher will be standardised in consultation with IDAI and when it is done, he will manufacture all crushers as per this standardized design. This will also help interchageability of spare parts. Till a prototype is geven to him by IDAI, he may manufacture as per the design he had.

b) That he will classify his stock of scrape iron into two groups (1) ordinary iron (ii). High Carbon steel. Parts such as plough shares, mould boards, etc... should be made from automobile spring steel which contains high carbon. Thus he will be able to utilize his scrape iron to the best advantage.

c) There is no arrangement for Factory Inspection in Haiti. However, safety precautions need to be taken to avoid accidents particularly melten metal is being used. All lifting and carrying devices should have a factor of safety of five. Though he has ably improvised the lifting device it is still not considered absolutely safe and needs strengthening. Adequate precautions need to be taken to make the operation safe.

IDAI

Dinkar N. Kherdekar
20/2/76
UNIDO Expert

b) Comments on Credit Project for utilization of bullocks and ploughs prepared by Mr. Weber Gibbs

My comments on the project are:

1. The price of the plough seems to be on higher side. Probably, the ploughs may be available for G.300 at Cayes being nearer the manufacturing centre (LABORDE). This needs to be checked.

2. For the purposes of calculating the depreciation on bullocks their life may be taken as seven years.

3. The depreciation for ploughs may be calculated by taking their life as ten years and not three years which is too low.

4. For feed and medicines an amount of G.500.00 has been set aside. Even assuming that part of the land is set aside for production of fodder, the amount of G.200 seems to be reasonable and for medicines, G.50.

5. I have shown these comments to Dr. Engels and he has suggested allocating some amounts for long ropes, which are used and which need replacements. This is a good suggestion and an additional amount of G.50 is to be added to item "Prix des équipements d'attelage".

The draft project needs revision on the lines mentioned above.

It may be mentioned here that in Haiti, the bullocks are at present being used for ploughing and partially for bullock-cart transport if a farmer owns a cart. Very few farmers seem to own a cart. In India there are separate and specialized bullock driven implements for different agricultural operations, as indicated below:

1) Plough for ploughing
2) Harrow for harrowing
3) An implement for crushing clods and for levelling and preparing seed-bed
4) Seed-drills for sowing seeds of various crops
5) Intercultural implements for hocing and weeding
6) Bullock carts for transport
7) Leather buckets or Persian wheels to lift water out of wells, tanks or cannals.

With these varied implements an Indian farmer is able to make use of a pair of his bullocks almost all the year round. At present, as a Haitian farmer has a steel plough, he can, at the most, use the bullocks say two to three months in a year, which is a low utilization. Slowly, as new implements are introduced and used, the utilization of bullocks will increase and become more and more economical

IDAI
18/2/76

D.N. KHERDEKAR
UNIDO Expert

APPENDIX XIII

Financial position of the Institute for Development of Agriculture and Industry, Port-au-Prince, Haiti - September 30, 1975.

1) Authorized Capital	G.50.000.000.00	$10.000.000.00
Paid-in Capital	21.434.181.00	4.286.836.20

Loans (In Gourdes - 5 Gourdes or 1 Dollar USA)

	Balance at the beginning of the year 9.30.74	Credit during the year	Reimbursement during the year	Balance at the end of the year 9.30.75
3) AGRICULTURE		GOURDES		
Crédit Supervisé (Crop loan)	1.062.941.30	2.138.533.65	942.803.90	2.258.671.05
Equipements & Implements	132.054.20	109.240.70	41.725.80	199.569.10
Poultry	131.739.90	694.196.25	158.374.20	667.561.95
Others	281.181.90	4.132.60	31.365.00	253.949.50
4) INDUSTRY	2.142.097.45	1.867.259.50	260.737.35	3.748.619.60
5) RURAL INDUSTRIES				
Sisal	21.504.00	-	21.504.00	-
Sugar Factory	117.362.70	-	98.965.80	18.396.90
Cotton(SEN)	-	996.155.10	-	996.155.10
Essential Oil(Warrant)	8[illegible].275.35	3.094.499.00	2.074.499.00	1.109.275.35
Agriculture Implements	240.000.00	-	-	240.000.00

INSTITUT DE DEVELOPPEMENT AGRICOLE ET INDUSTRIEL
DIVISION FINANCIERE

APPENDIX XIV

A list of persons who assisted in the project

1) United Nations Development Organization Port-au-Prince, Haiti

1. Mr. Antonio Patriota, Resident Representative
2. Mr. Michael Askwith, Assistant to Resident Representative
3. Mr. Robert Daoud, Administrator
4. Mr. Aurel de Alth, Principal Councillior of PAM
5. Mr. Pierre Bernheim, FAO Representative
6. Dr. John Calicar, Veterinary Councillior, FAO
7. Mr. Dirk Engels, Expert in animal production
8. Mr. Pierie Courtine, Expert in Rural Artisans Training
9. Mr. Gerard Lambert, Expert in Industrial Programming
10. Mr. Jean Marie Deboutte, Office-in-Charge
11. Institute for Development of Agriculture and Industry (IDAI)
1. Mr. Georges Louis, General Director
2. Mr. Bernard Fathon, Dy. General Director (Ad.)
3. Mr. Rene Laroche, Director, Division of Assistance, Technique, and Development (DAID)
4. Mr. Fritz Mich[illegible], Director, Agricultural Group Service (SARGA)
5. Mr. Shiller Nicolas, Inspector (SARGA)

6. Mr. Marcel Thebaud, Inspector (SARGA)
7. Mr. St. Ange Cesar, Inspector (SARGA)
8. Mr. Sterlin Jean, Sous Directeur (Group Industrial Services)
9. Mr. Yvon Nerestant, IDAI, Mirebalais
10. Mr. Frisky Auguste, IDAI, Cayes, Agronomist

III. Miscellaneous

1. Mr. Raouf P. Hage, Manager, Outilagri, Port-au-Prince
2. Mr. Gerard Boucard, Vice President, DAR BOUCO, Port-au-Prince
3. Mr. Sprumont Jean, Evêché des Cayes, Laboule
4. Mr. Isaac Celestin, Foundry Owner, Cap Haitien
5. Mr. Wally Turnbull, Baptist Mission (Mountain Maid), Fermathe

APPENDIX XV

Some useful information

Currency : 1 Gourde (G) - 20 Cents U.S.
1 U.S. Dollar - 5 Gourdes (G.)

Land Measure : 1 carreau - 1.29 Hectares

Abbreviations :

IDAI	: Institute for Development of Agriculture and Industry
SEN	: Société d'Equipement National
DARNDR	: Département de l'Agriculture, des Ressources Naturelles et du Développement Rural
CRDDEM	: Centre Rural de Développement de Milot
BRRH	: Banque Nationale de la République d'Haiti
BCA	: Bureau de Crédit Agricole

IHS	:	Institut Haitien de Statistiques
ISO	:	International Sugar Organization
OAS	:	Organization of American States (Organization des Etats Américains)
HASCO	:	Haitian American Sugar Company S.A.
Outilagri:		
CARICOM:		Caribbean Community
ODM	:	Ministry of Overseas Development
SERPI	:	Service, Etudes et Réalisation de Projets Industriels (IDAI)
LDC	:	Least Developed Country
m/m	:	man months
PAG	:	Protein Advisory Group of United Nations System
UNDP	:	United Nations Development Programme
UNIDO	:	United Nations Industrial Development Organization
FAO	:	Food and Agricultural Organization of the United Nations
ILO	:	International Labour Organization
IBRD	:	International Bank for Reconstruction and Development
IPF	:	Indicative Planning Figure
SIS	:	Special Industrial Services
IRRI	:	International Rice Research Institute Manila, Philippines
ACC	:	Asian Coconut Committee
Ha.	:	Hectare

APPENDIX XVI

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4. Report of National Council for Development and Planning.(CONADEP) Ref. c/PNUD-No.65, 12/10/72.
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6. Haiti - Preliminary Survey of the Sugar Industry, Sept. 1975 by Mr. Luis Smith of Bookers, Agricultural and Technical Services, Ltd., Bucklersbury Home, 83 Cannon Street, London, EC4N-8EJ
7. A preliminary investigation into the technical and economic feasibility of sugarcane production by Mr. C. Keith Laurie, "Olenaire", Reservoir Road Britton Hill, St. Michael, Barbados, W.I.
8. Rapport d'activité du projet TF/LAO/72/005 pour la période 1/04/74 to 30/09/74 and Catalogue of products of "Lao Industry Mechanic Workshop and Foundry, LAOS.
9. A standard guide to Haiti by Selden Rodman
10. 'HAITI' by Bernard Hermann
11. Berclays Country Reports - Haiti - 12 Feb. 1975
12. Market profile - Haiti
13. Encyclopedia biologique - Les plantes alimentaires, Part I by D. Bois published by Paul Lechevalier, Paris.

APPENDIX XVII

SKETCHES AND DIAGRAMES

CONTENTS

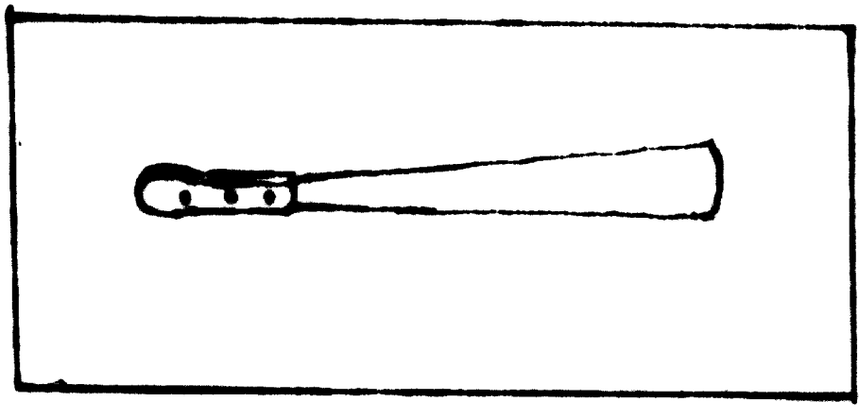


FIG. 1 MACHETE

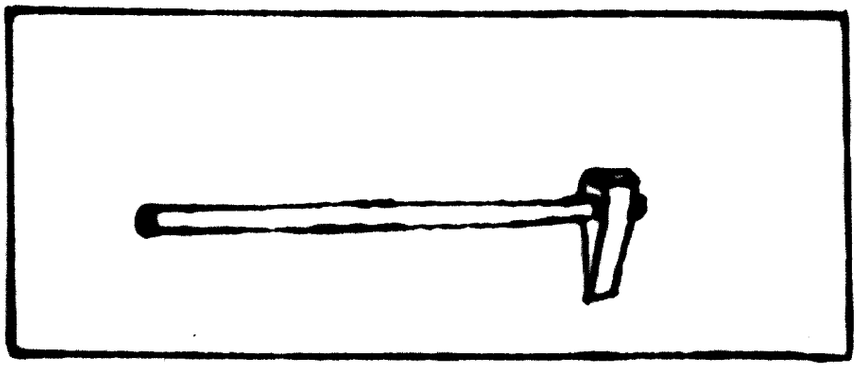


FIG. 2 AXE

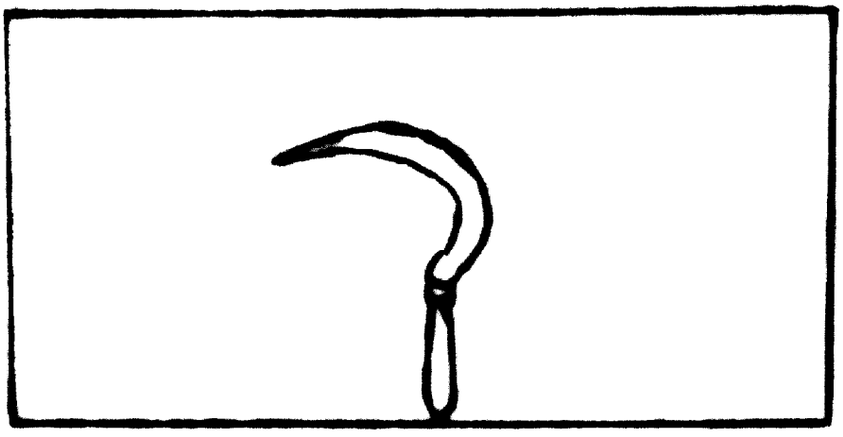


FIG. 3 BILLHOOK TYPE (UK) SICKLE

FAUCILLE OR SERPETTE

COUTEAU DIGO - CREOLE.

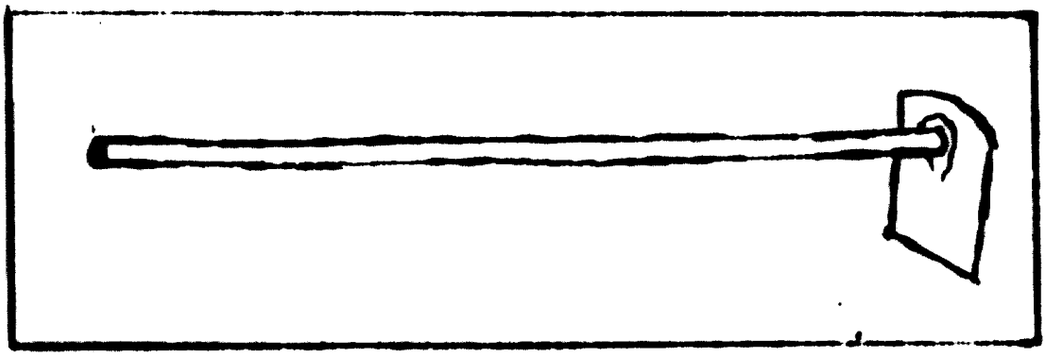


FIG. 4 LONG HANDLED HOE

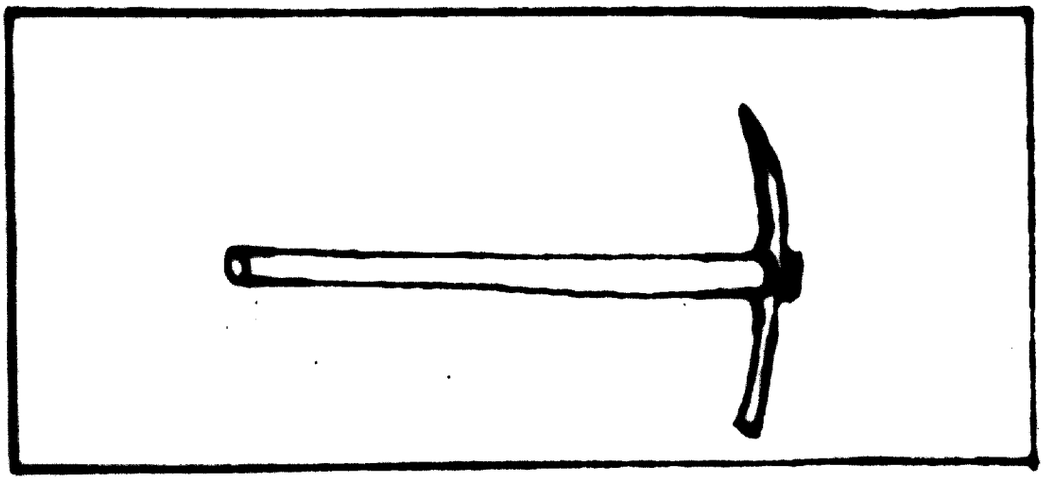


FIG. 5 PICKAXE (PICKAXE) STANDARD

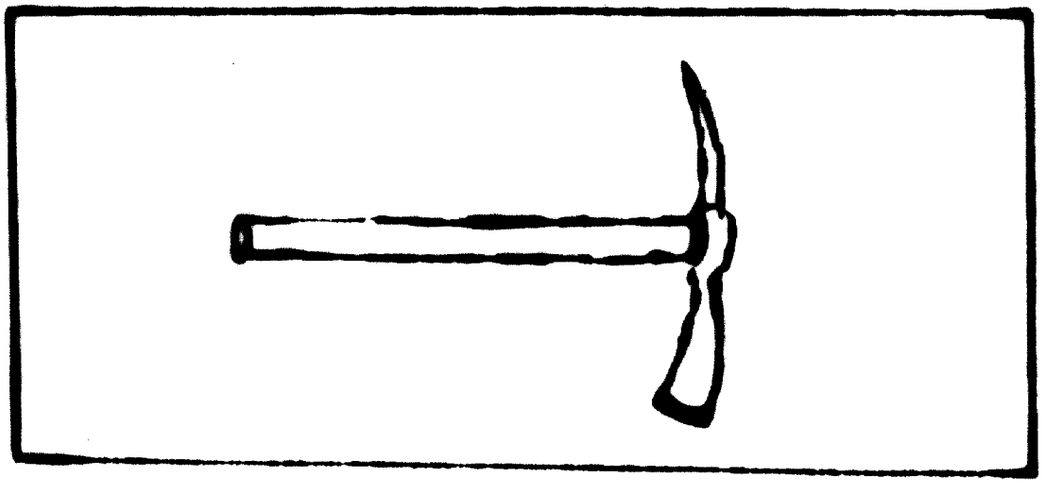


FIG. 6 PICKAXE (MATTOCK) FOR CUTTING ROOTS

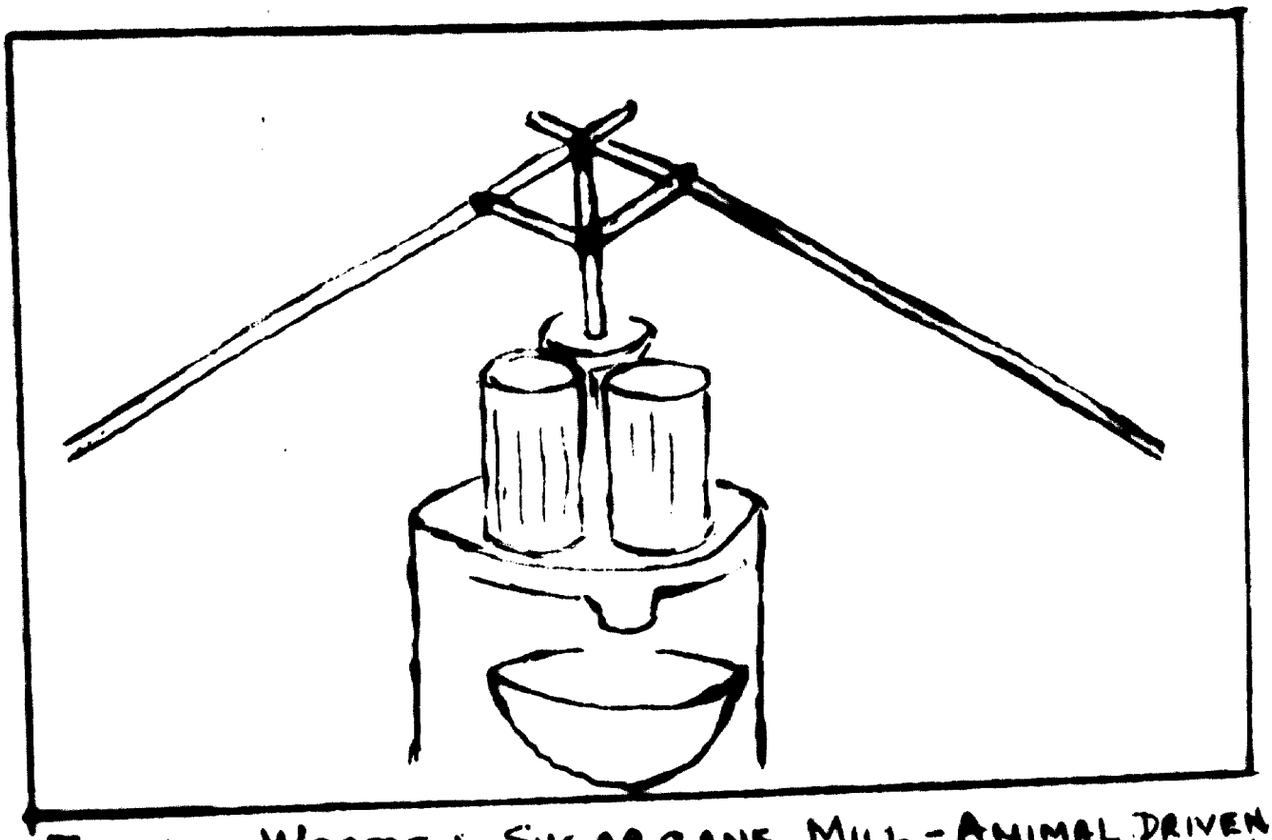


FIG. 10 WOODEN SUGARCANE MILL - ANIMAL DRIVEN

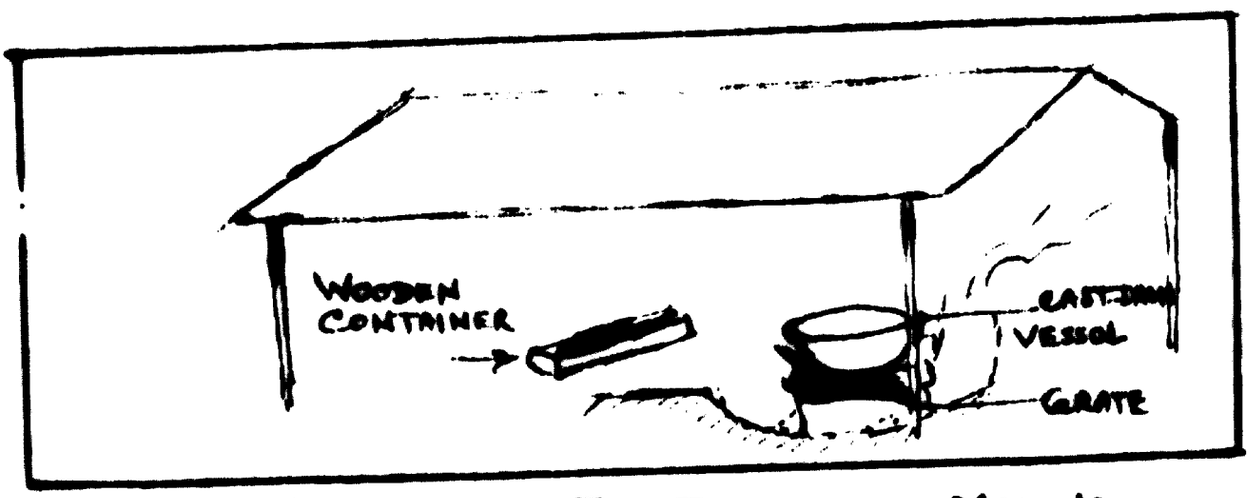


FIG. 11 A FURNACE FOR RASPADORE MAKING

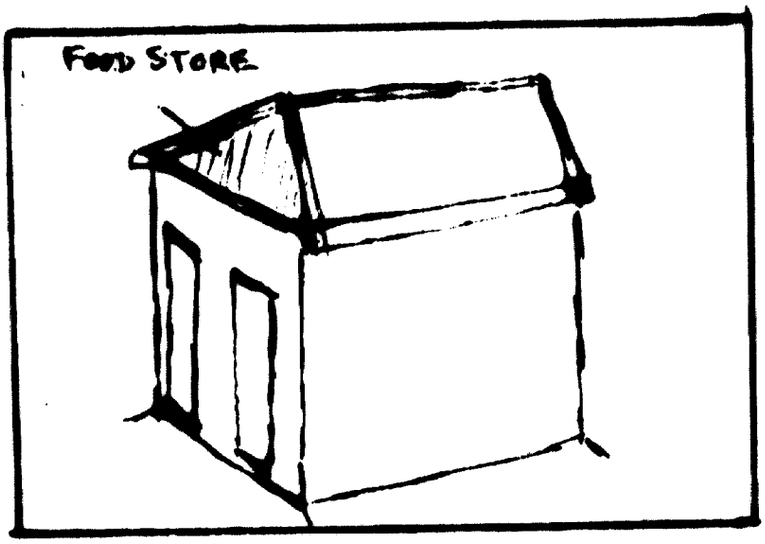


FIG. 12 USUAL HAITIAN HUT WITH SPACE FOR FOOD STORAGE

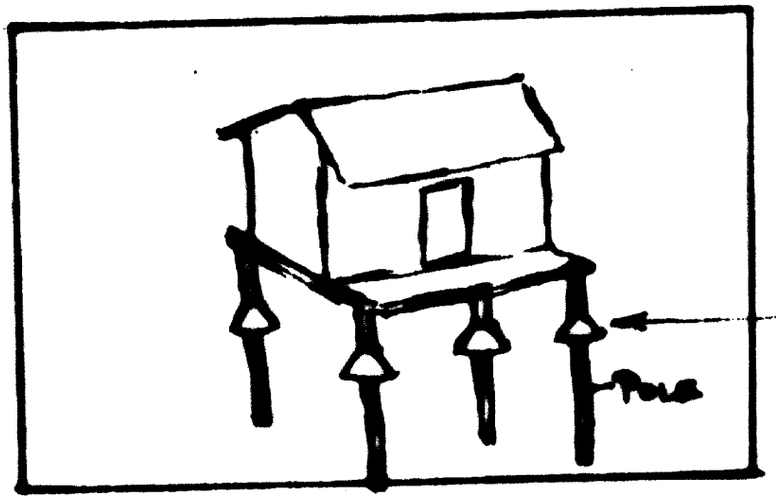


FIG. 13 GRAIN STORAGE

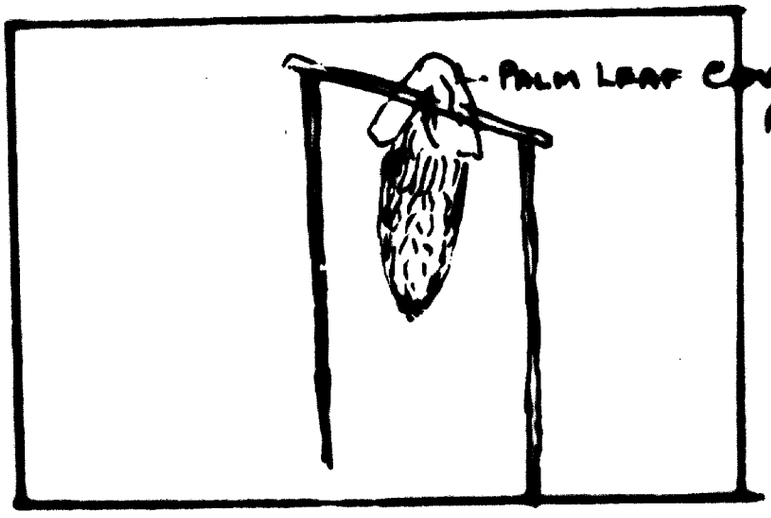


FIG. 14 METHOD OF STORING MAIZE COBS

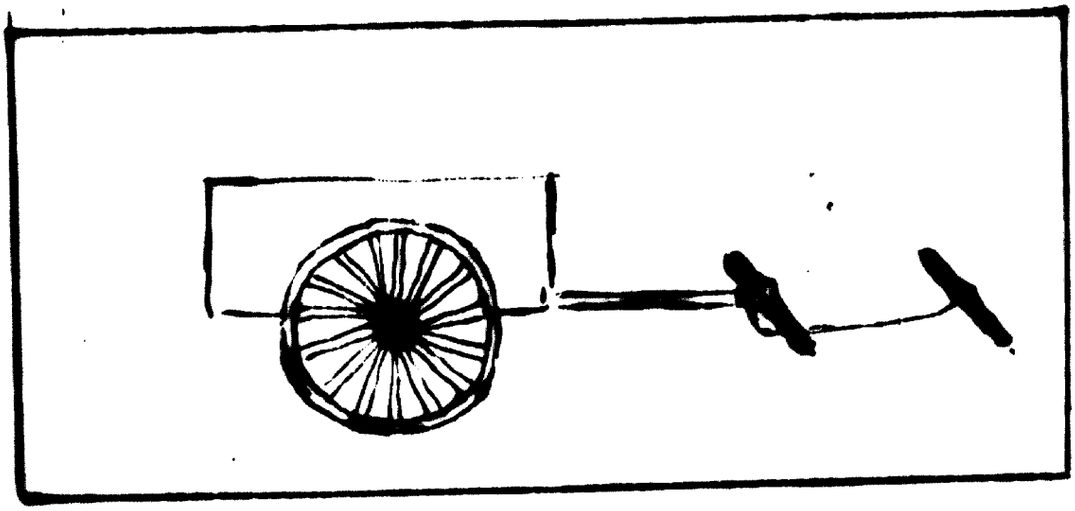


FIG. 15 BULLOCK CART WITH TWO YOKES

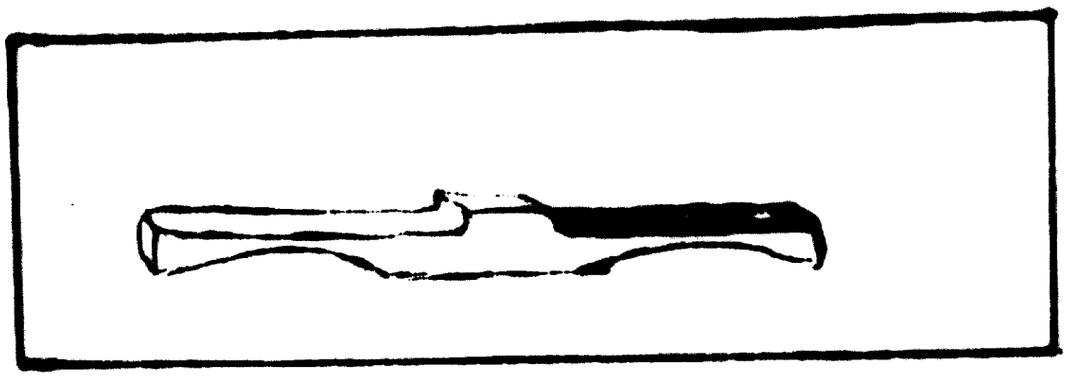


FIG. 16 HAITIAN YOKE.

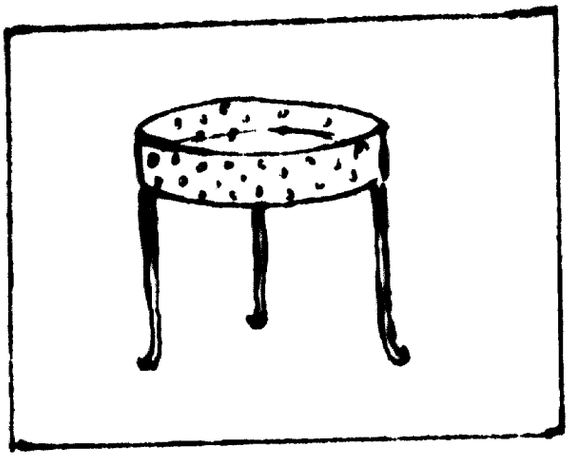


FIG 17 CHARCOAL STOVE

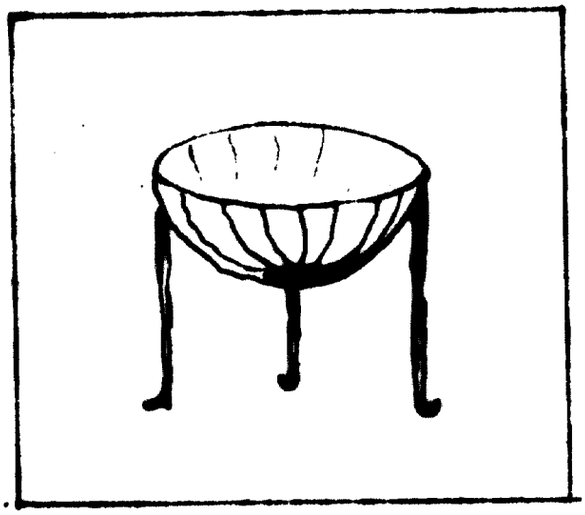


FIG 18 CHARCOAL STOVE - ANOTHER TYPE

FIG 19 - MOULD BOARD PLOUGH FOR HILLS

(CHARRUE OR RARA.
PRICE $75)

FIG. 20 RIDGER PLOUGH, PRICE - $85

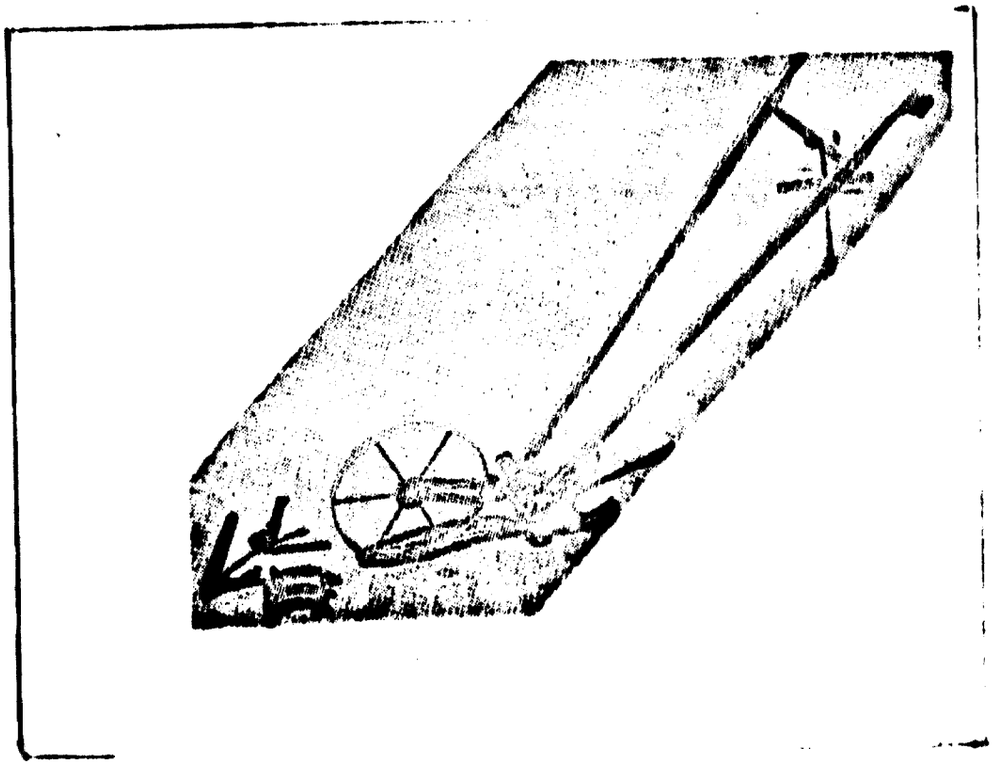


FIG. 23 WHEEL HOE WITH ATTACHMENTS

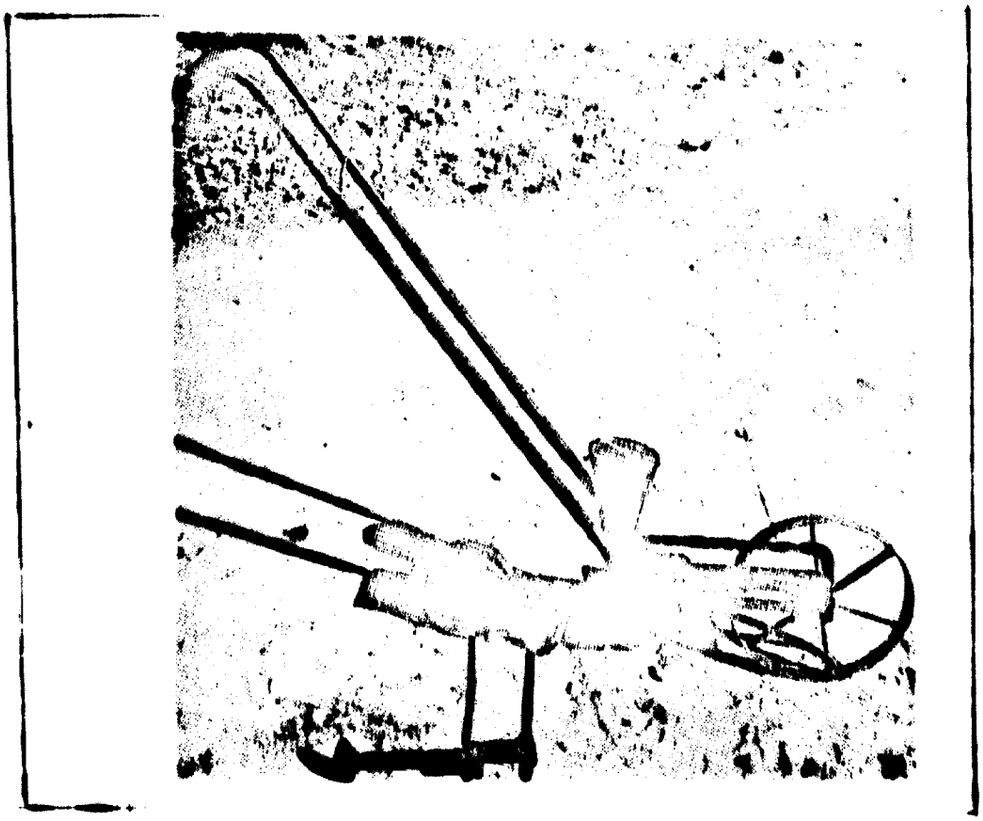


FIG. 24 SEED DRILL, HAND OPERATED

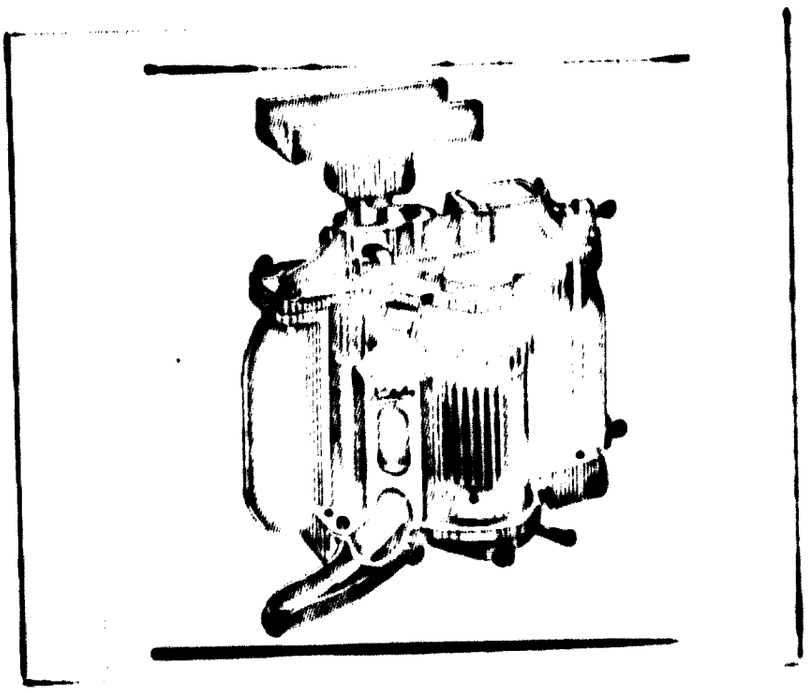


Fig. 2a

Fig. 2b

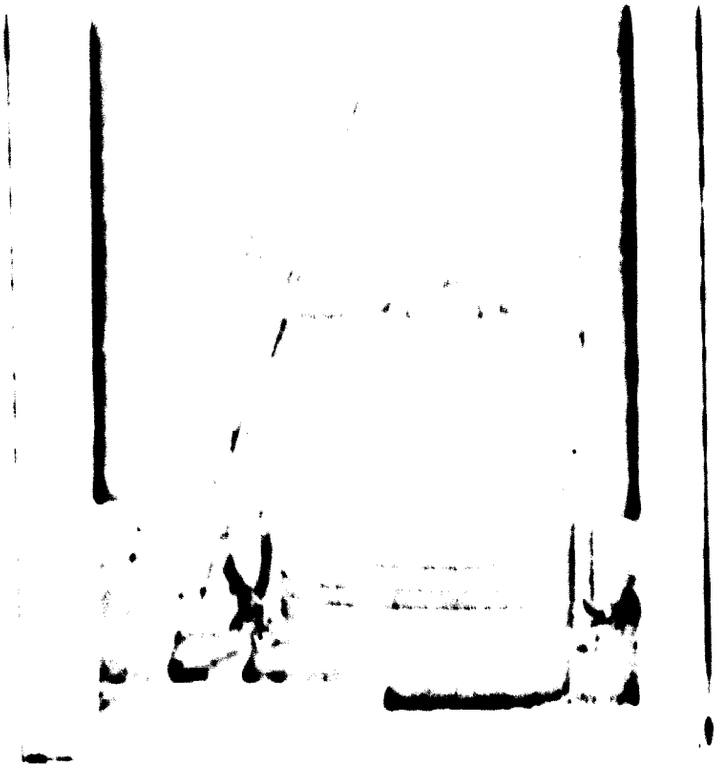


Fig. [illegible]

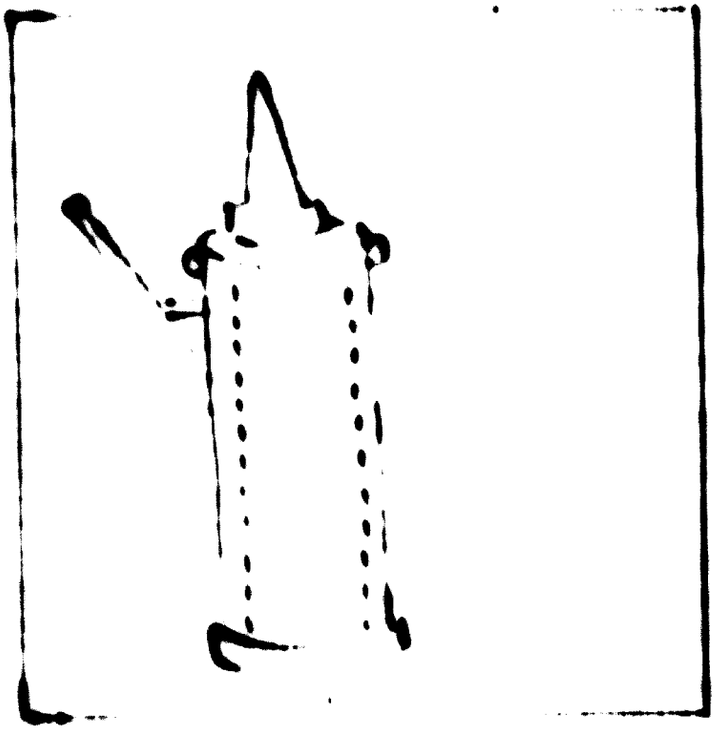


Fig. [illegible]

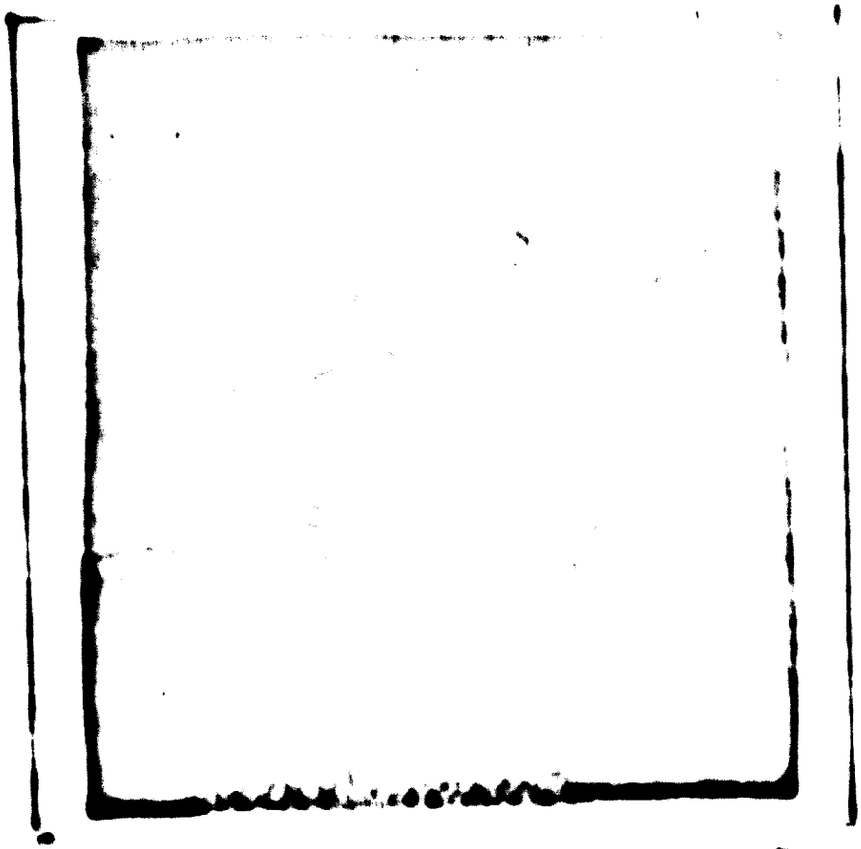


Fig 29 [illegible] (Price $20)

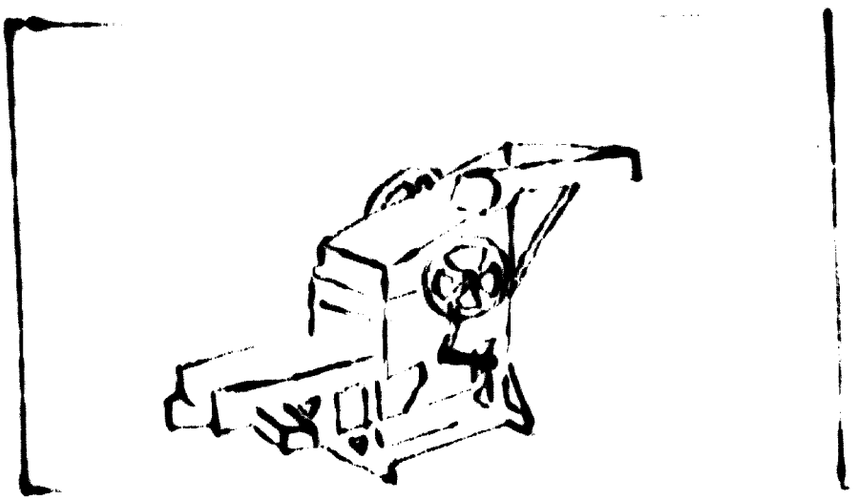


Fig. 30 [illegible] (Price $40)
(Big Size RANSOMES)

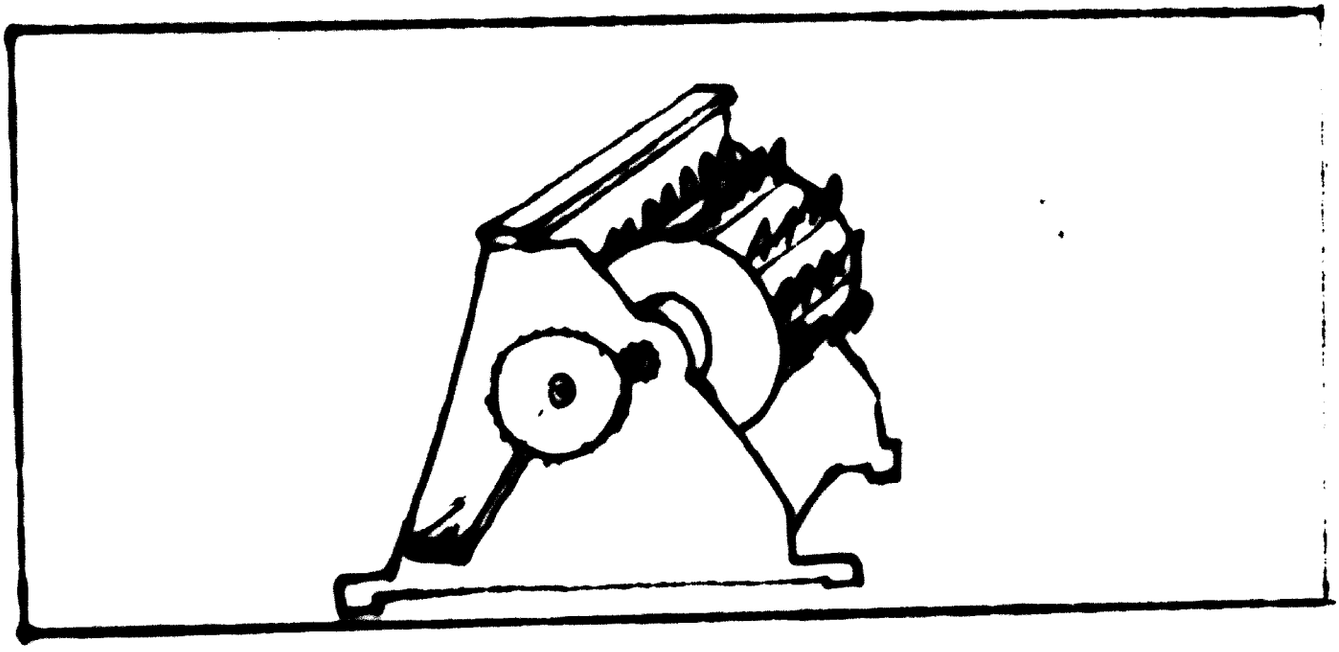


FIG. 31 PADDY THRESHER, PEDAL OPERATED

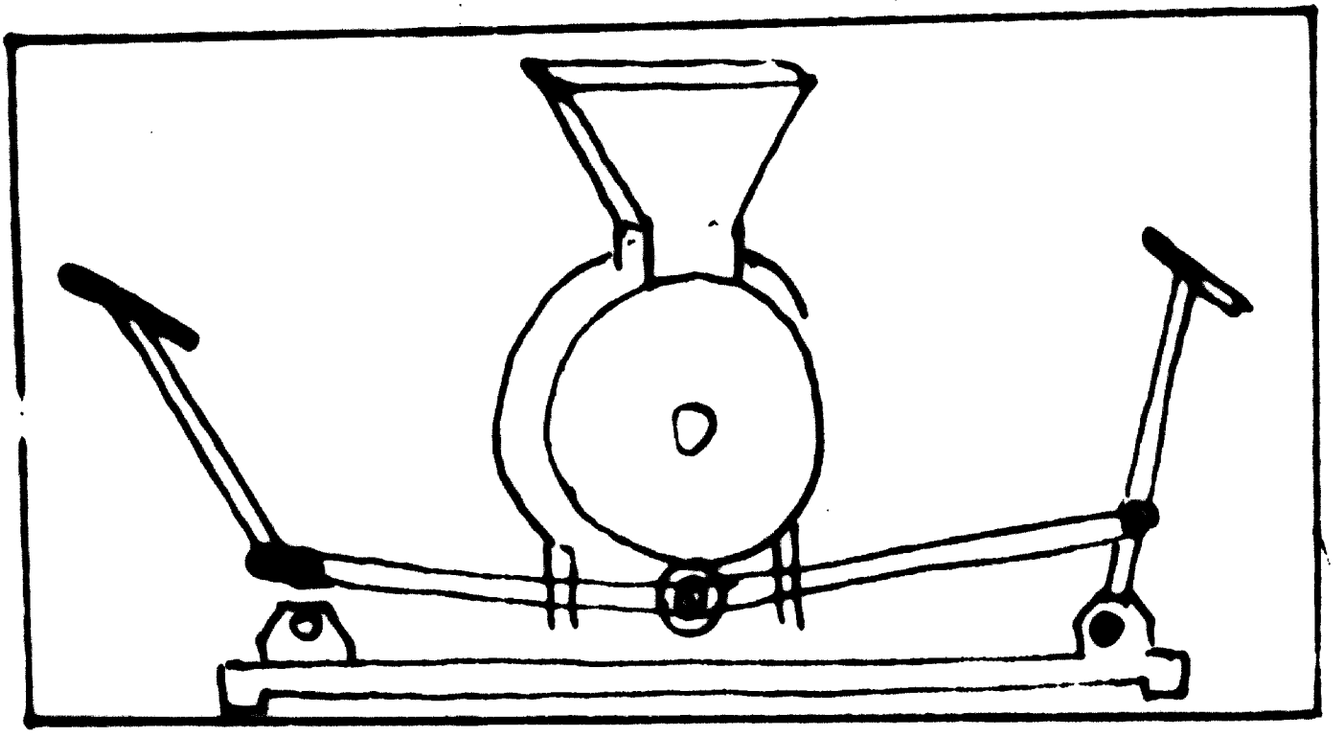


FIG. 32 PADDY SHELLER, TWO-MAN OPERATED, JAPANESE IMPACT TYPE

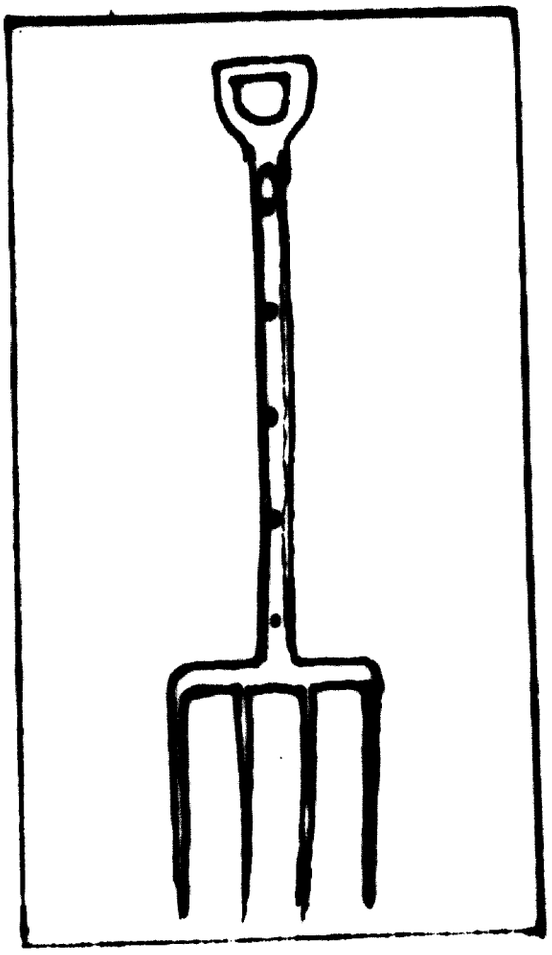


FIG. 33 DIGGING FORK.

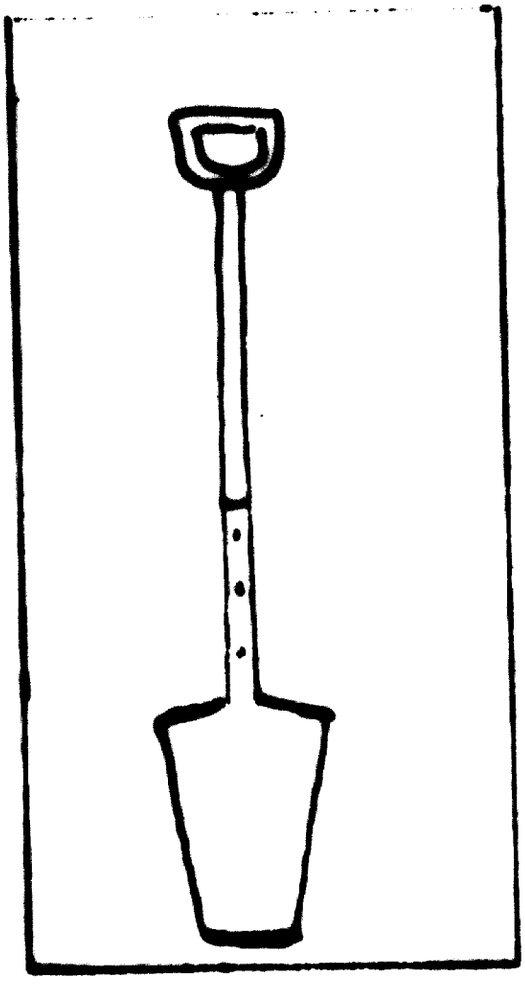


FIG. 34 SPADE

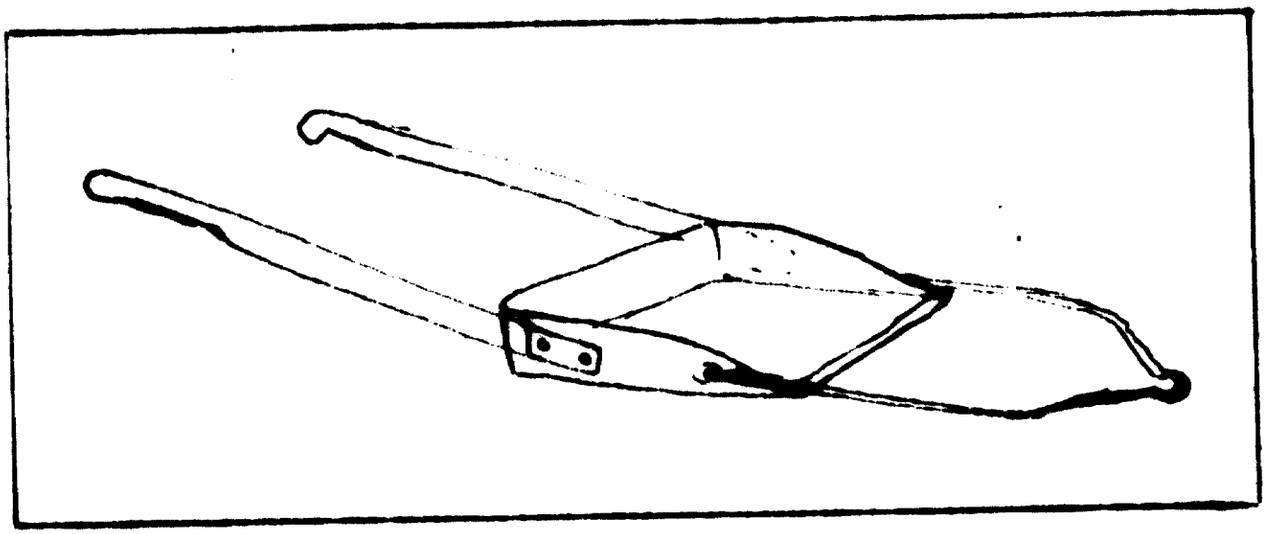


FIG. 35 SOIL SCOOP.

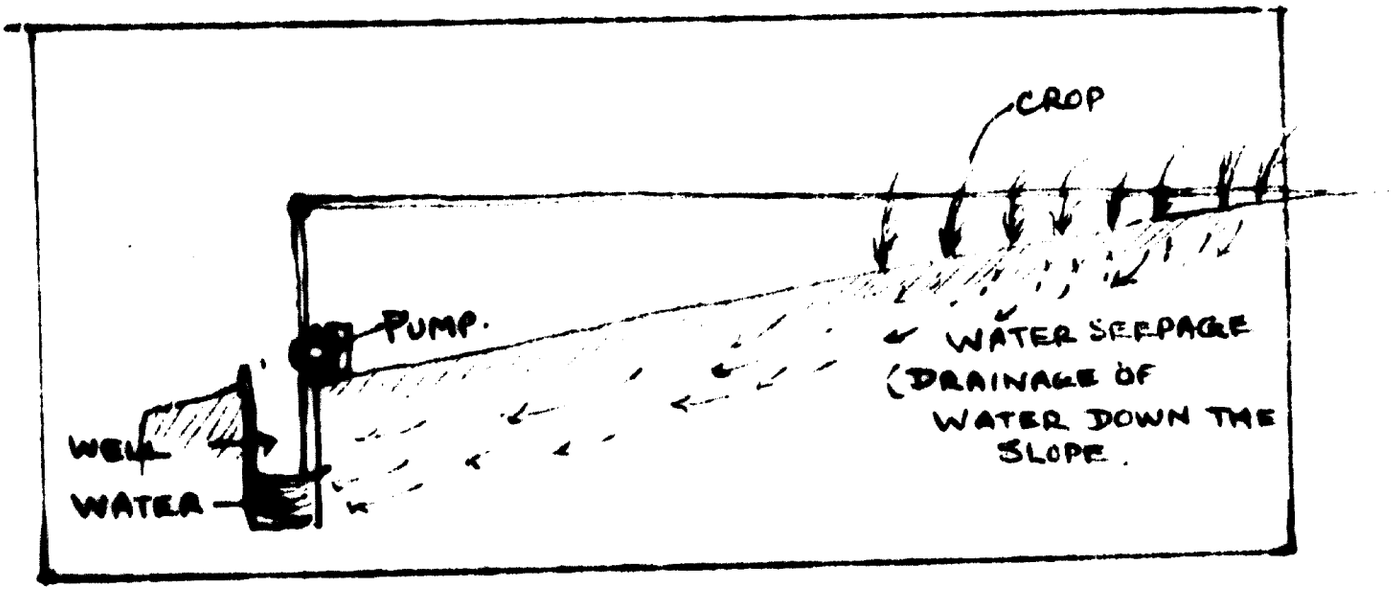


FIG. 36 IRRIGATION WELL AT LOWER LEVEL, RECUPERATION TO SOME EXTENT

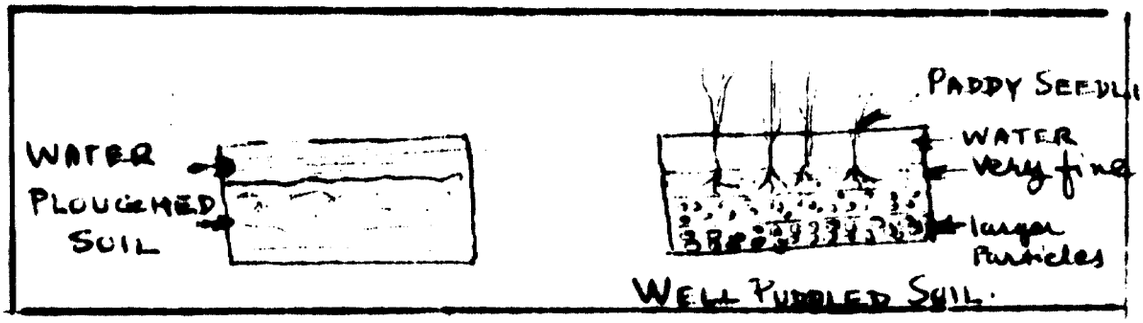


FIG. 37 PUDDLING GIVES VERY FINE SEED BED FOR PADDY SEEDLINGS.

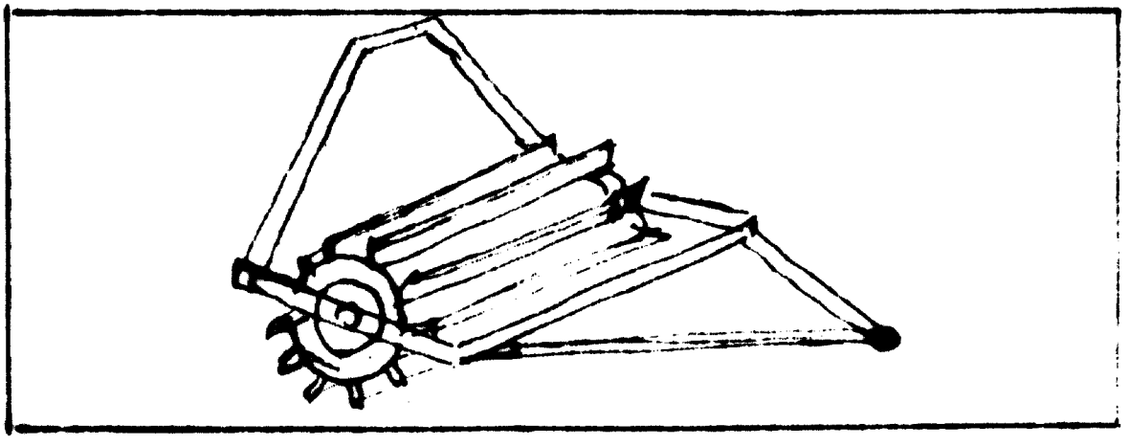


FIG. 38 . BURMESE SATOON – PUDDLER

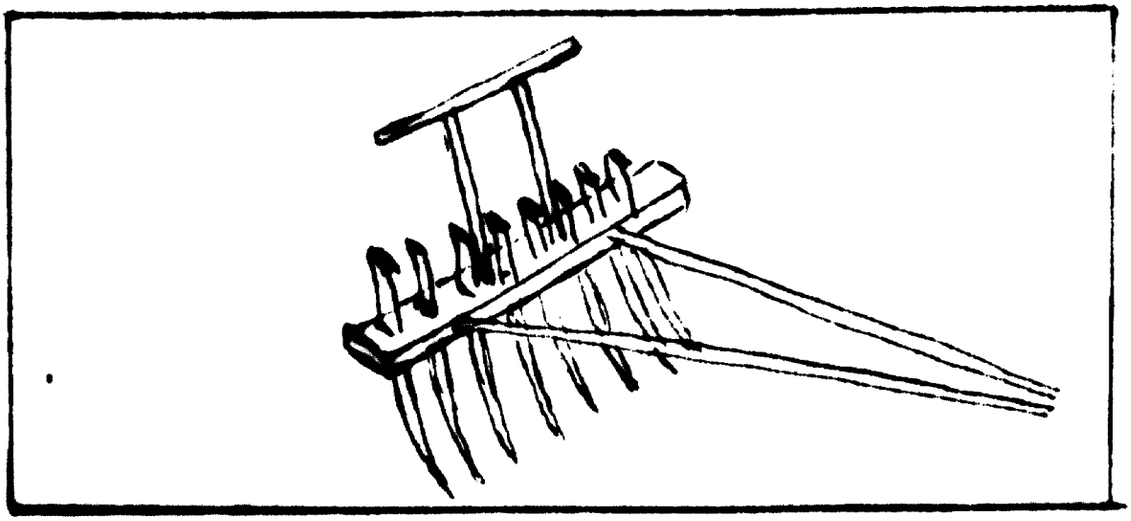


FIG. 39 TOOTHED HARROW FOR PUDDLING PADDY FIELDS USED IN INDO-CHINA

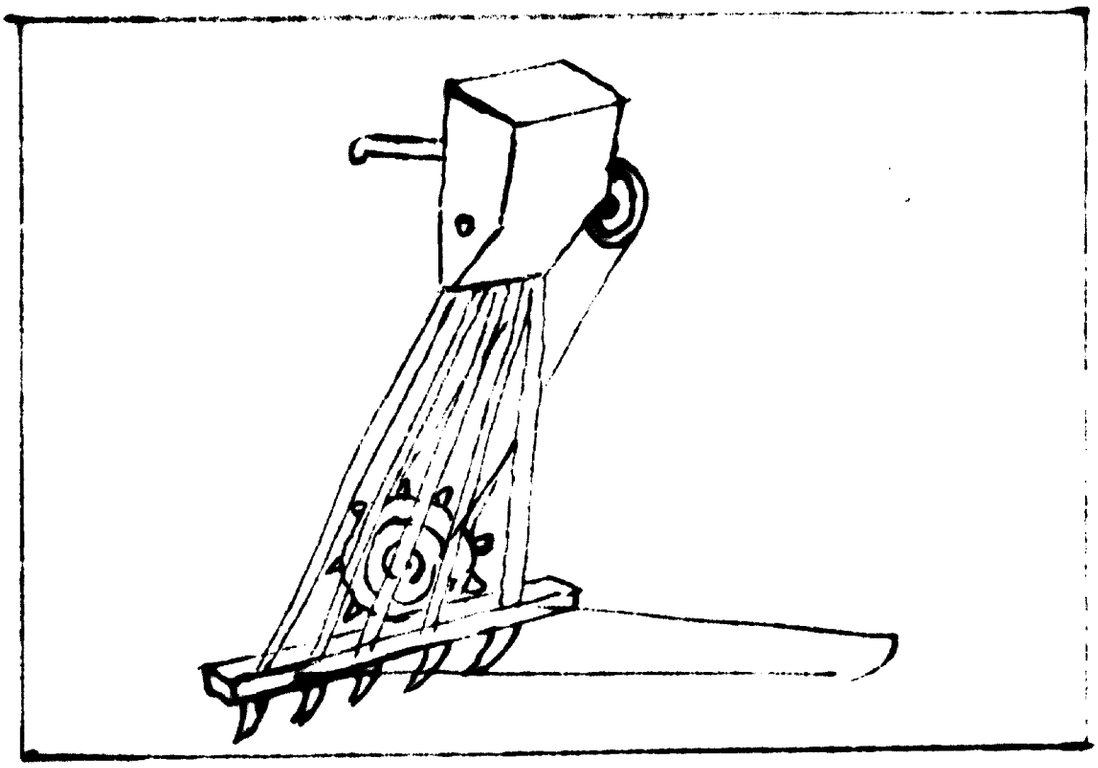


Fig. 40 A MACHINE FOR PLANTING GERMINATED PADDY. (International Rice Research Institute, Manila)

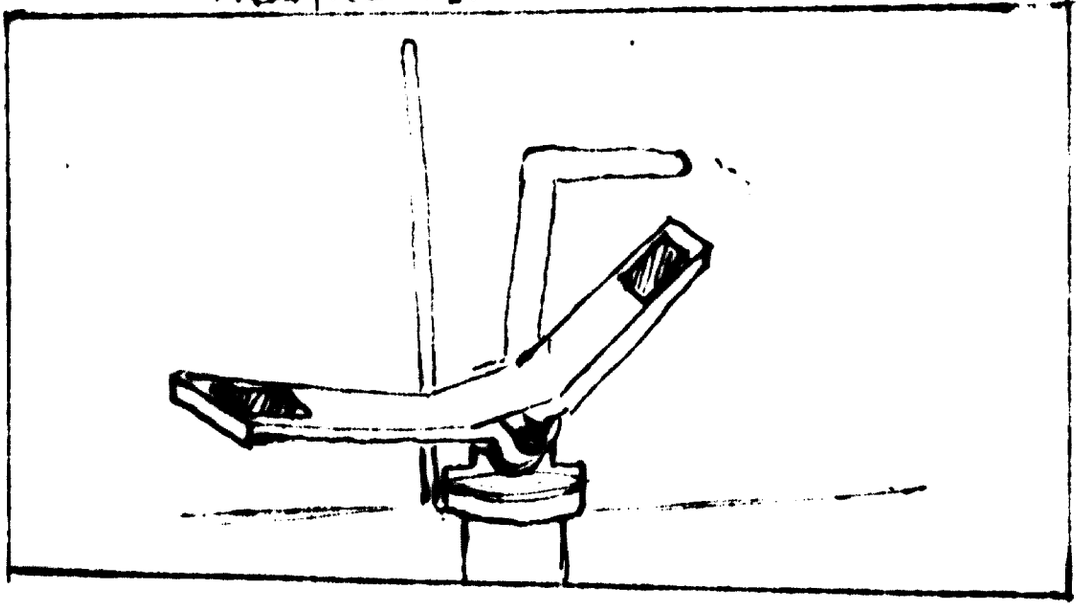


Fig. 41 FOOT DIAPHRAGM PUMP FOR LOW LIFTS. (International Rice Research Institute Manila)

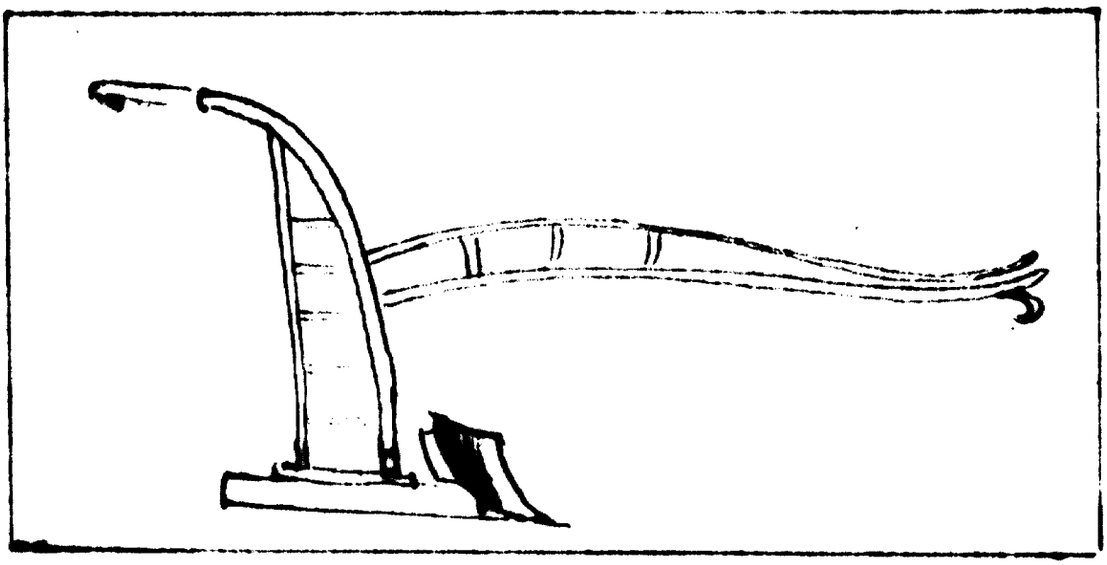


FIG. 42 LAOS PLOUGH

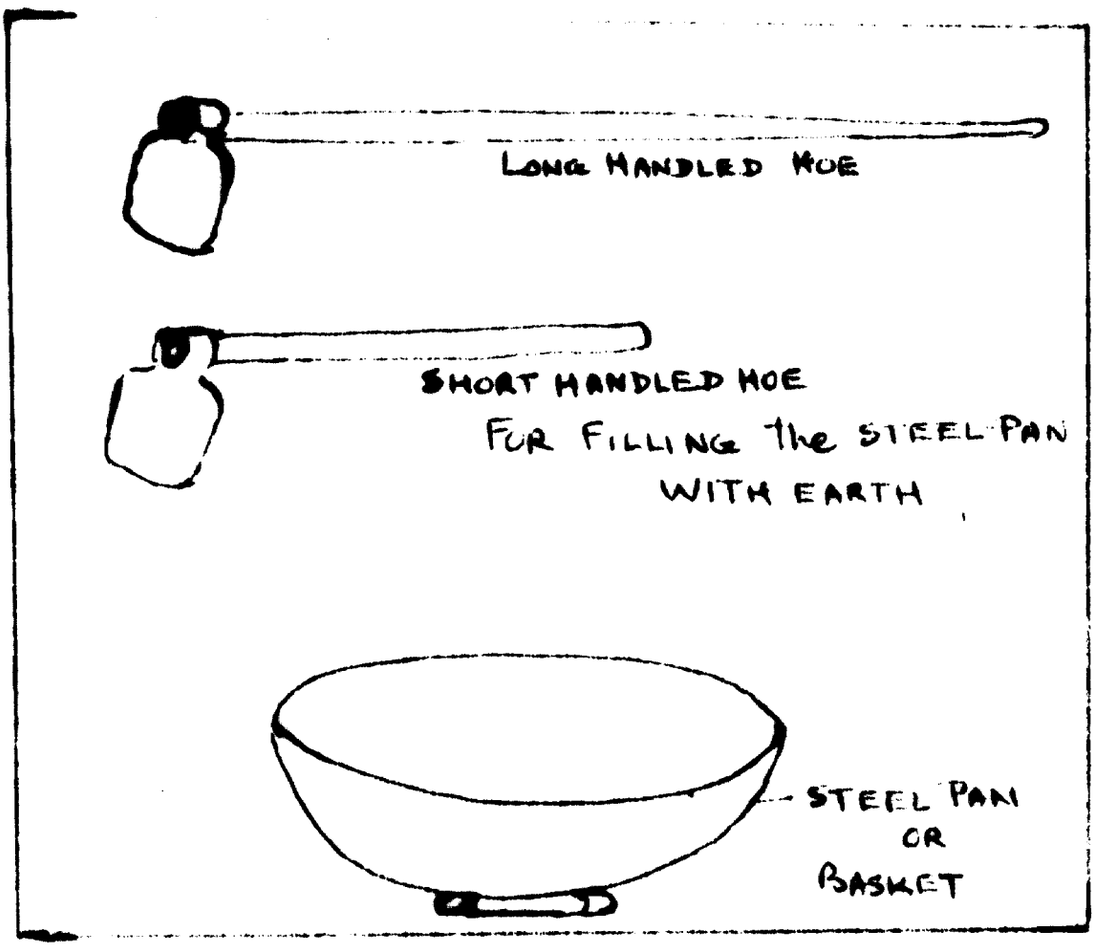


FIG. 43 EARTH MOVING TOOLS

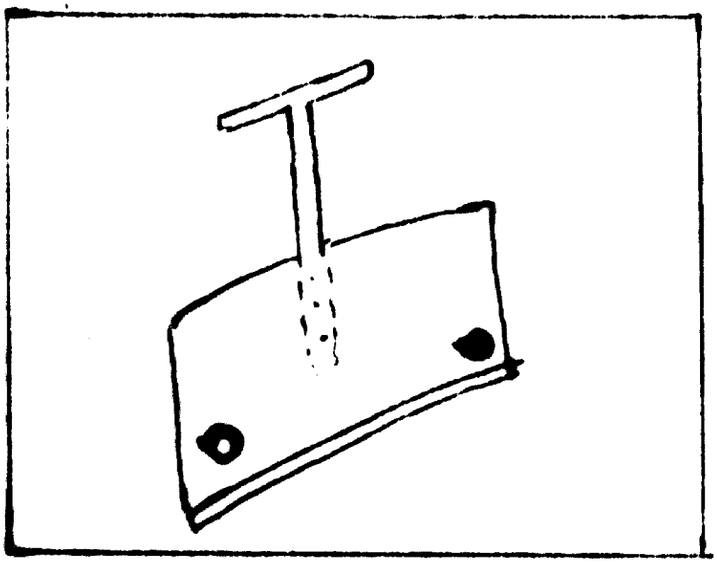


FIG. 44 KENI OR LEVELLING BOARD

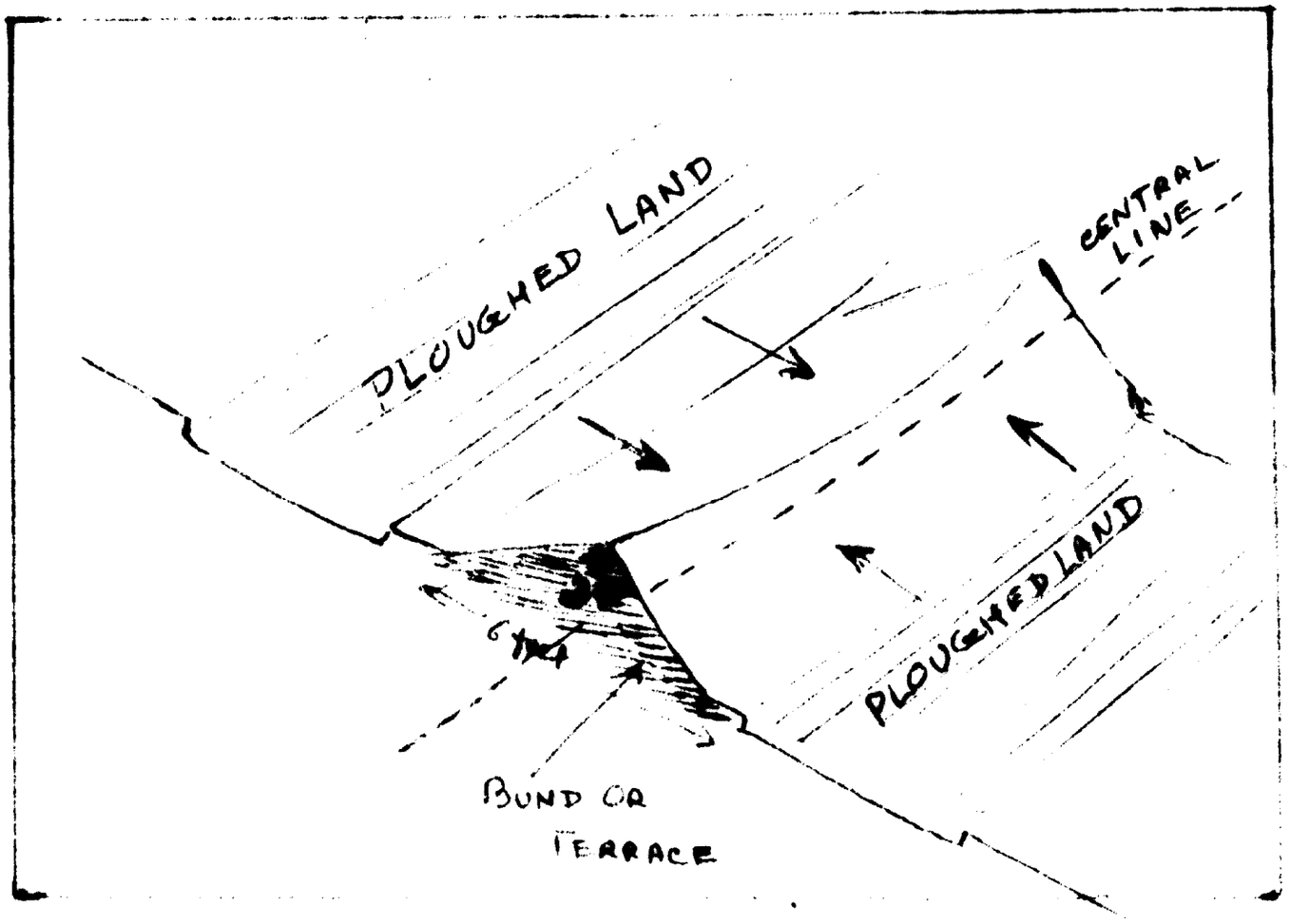


FIG. 45 METHOD OF FORMING BUND OR TERRACES WITH KENI. (LOOSENED SOIL from both sides is moved by Keni as shown by arrows

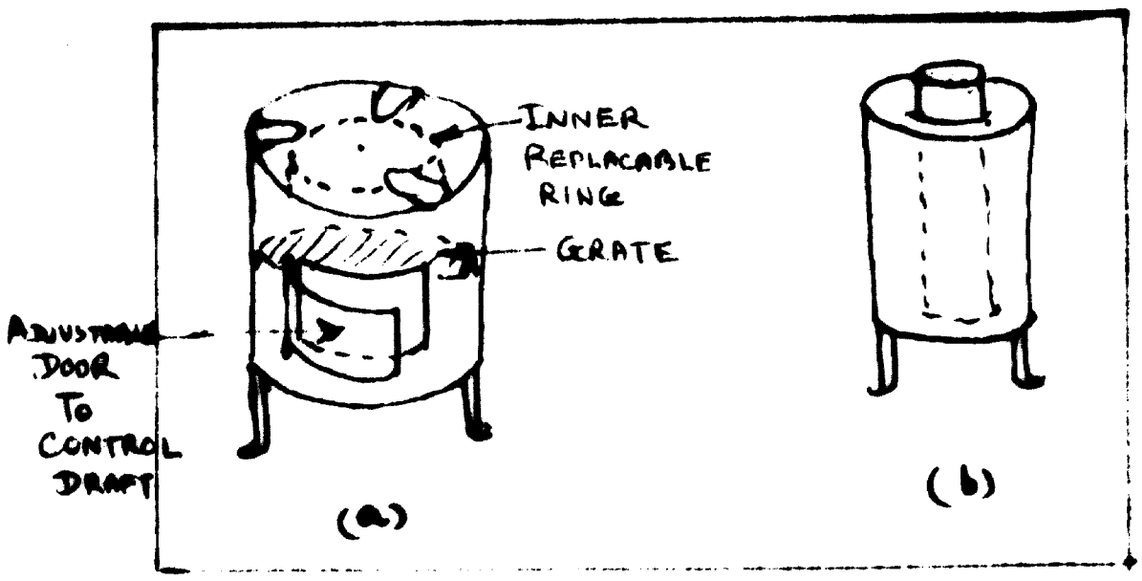


FIG. 46 (a) IMPROVED CHARCOAL STOVE
(b) SAW DUST STOVE

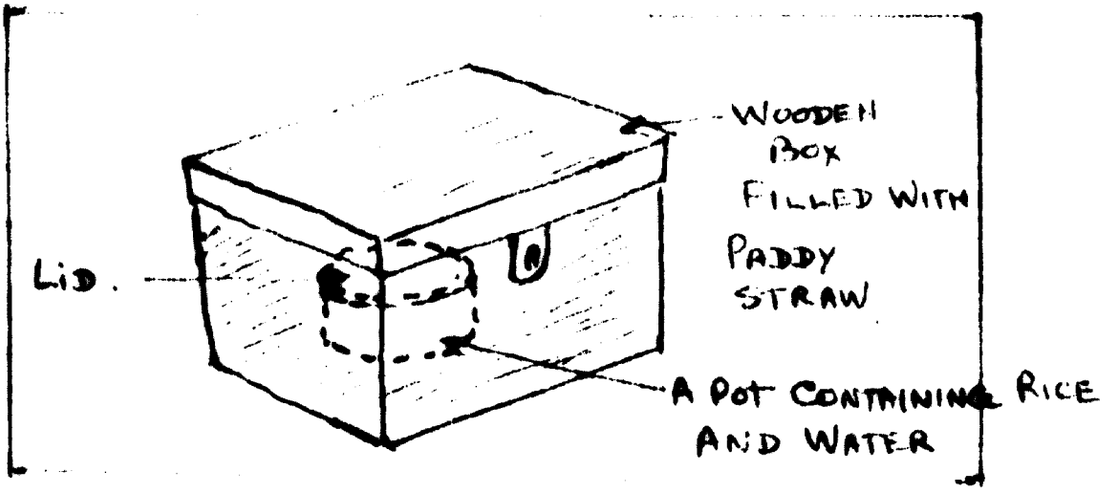


FIG. 47 - A METHOD OF COOKING RICE

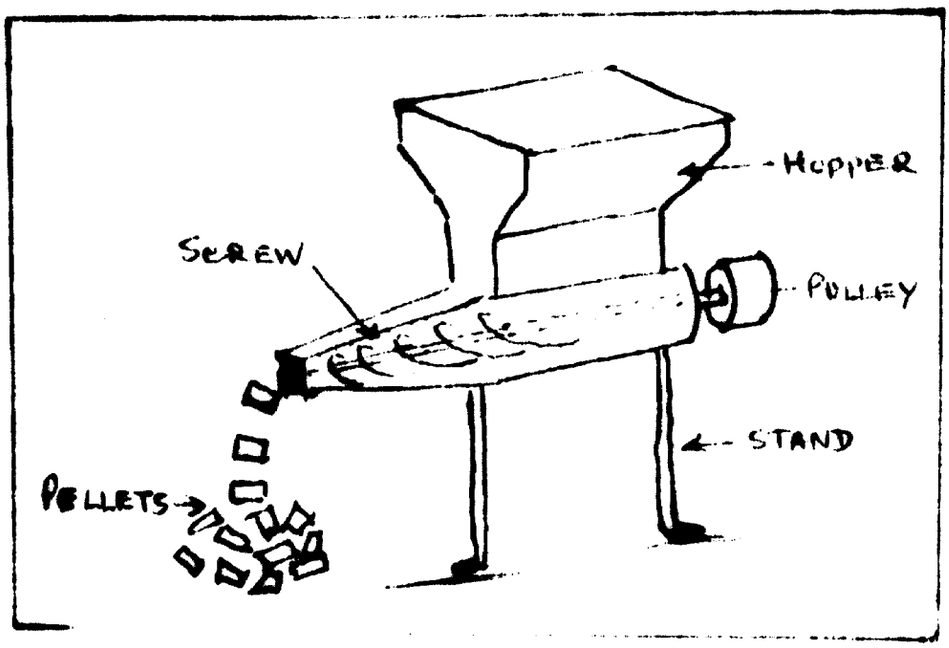


FIG. 48 CHARCOAL DUST PELLET MAKING MACHINE

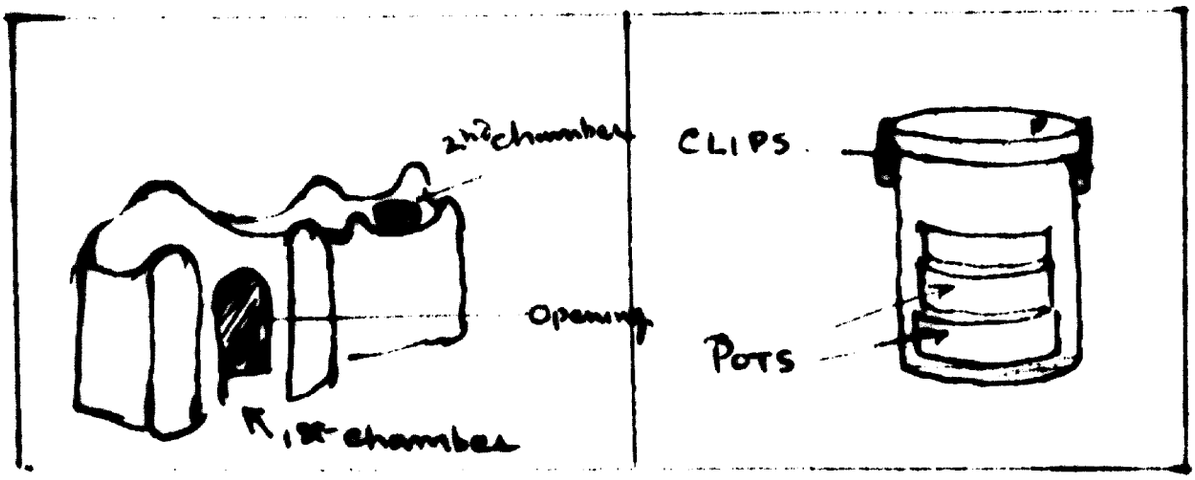


FIG. 49(a) TWO CHAMBERED WOOD STOVE (b) SIMPLE PRESSURE COOKER

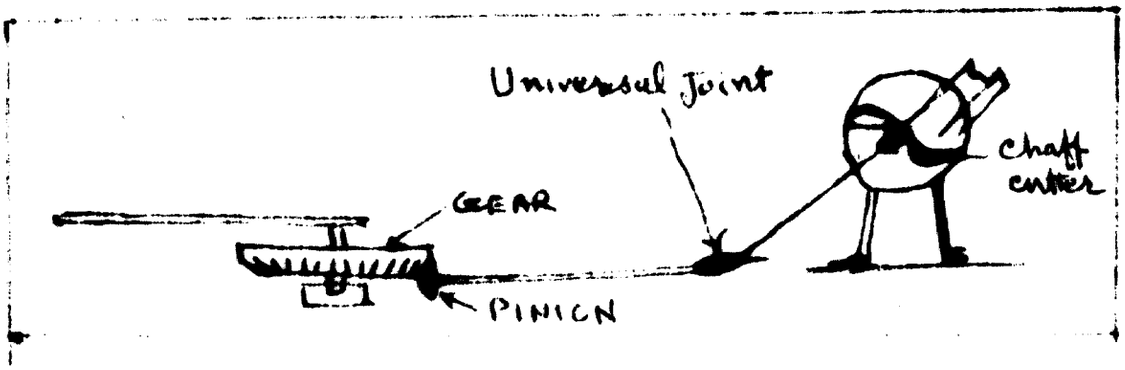


FIG. 50 BULLOCK GEARS TO INCREASE REVOLUTIONS

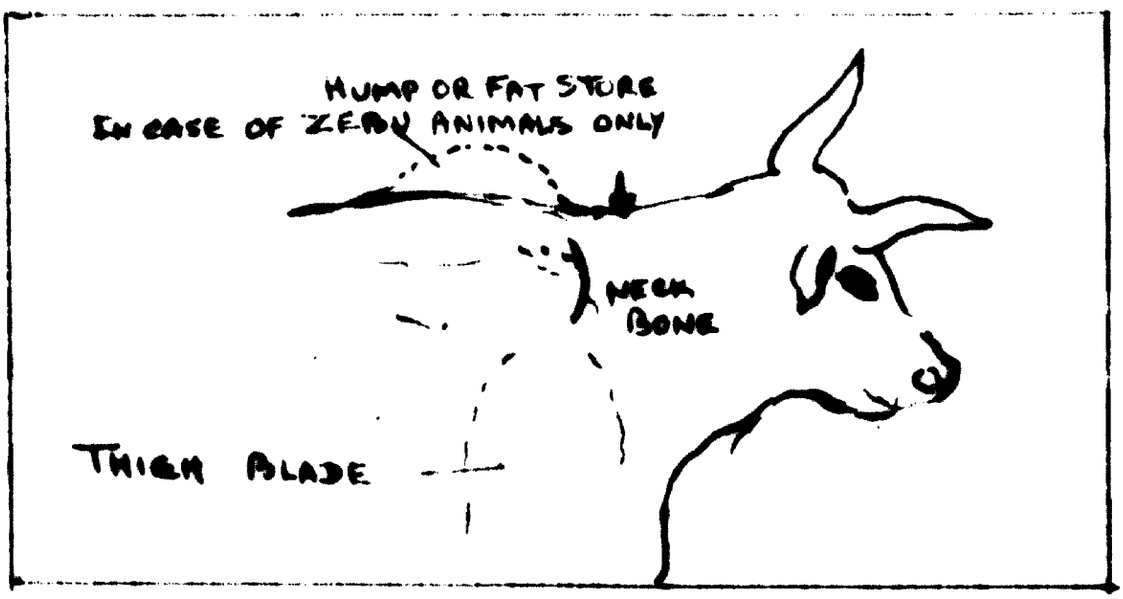


FIG. 51 - SKETCH SHOWING NECK BONE WHERE YOKE GIVES BEST POWER on BULLOCKS

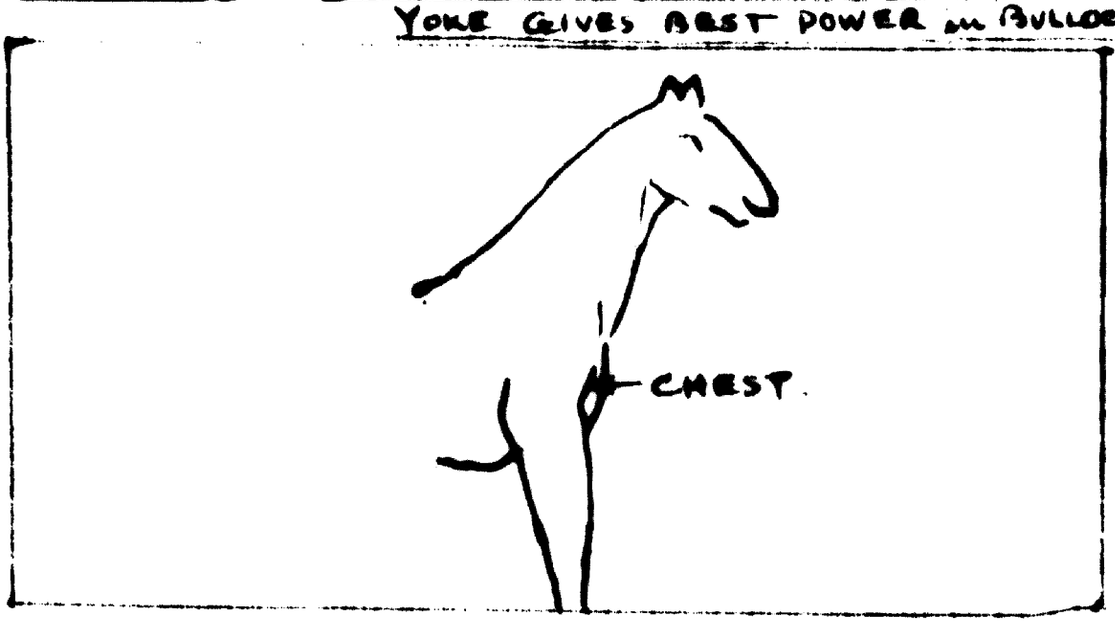
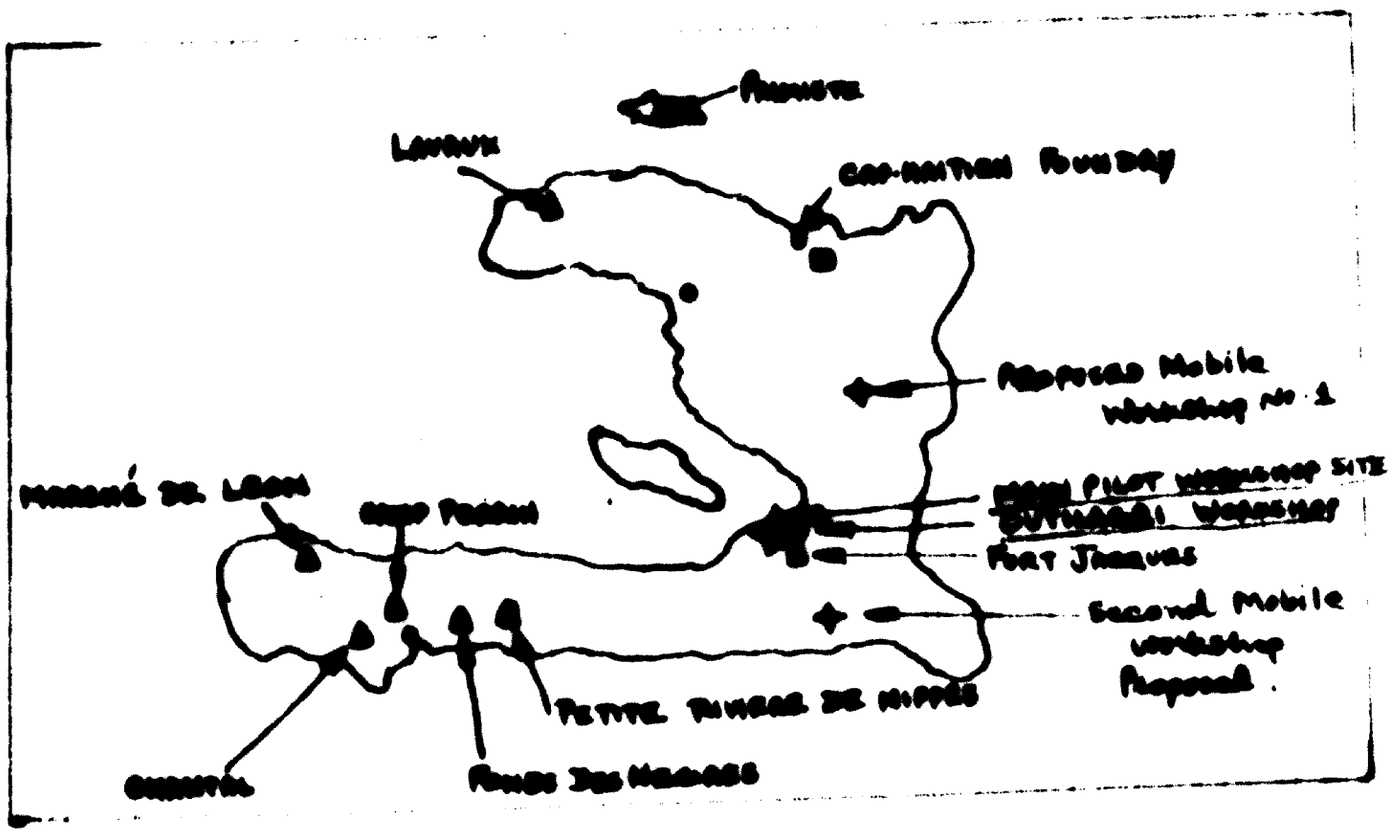


FIG. 52 HORSE GIVES BEST POWER IF YOKED AT CHEST AND NOT AT NECK BONE



◆ Mobile Workshops Proposed
▲ Rural Artisans Training
Workshops
★ Port-au-Prince - Main Pilot
Workshop and Outlaying
Aid Haiti Metals Fab. Wks.
and National Foundry Fab. Wks.

Fig. 53 - A map of Haiti showing distribution of Workshops

A MAP OF HAITI SHOWING PLACES VISITED SO FAR AND PROPOSED TO BE VISITED

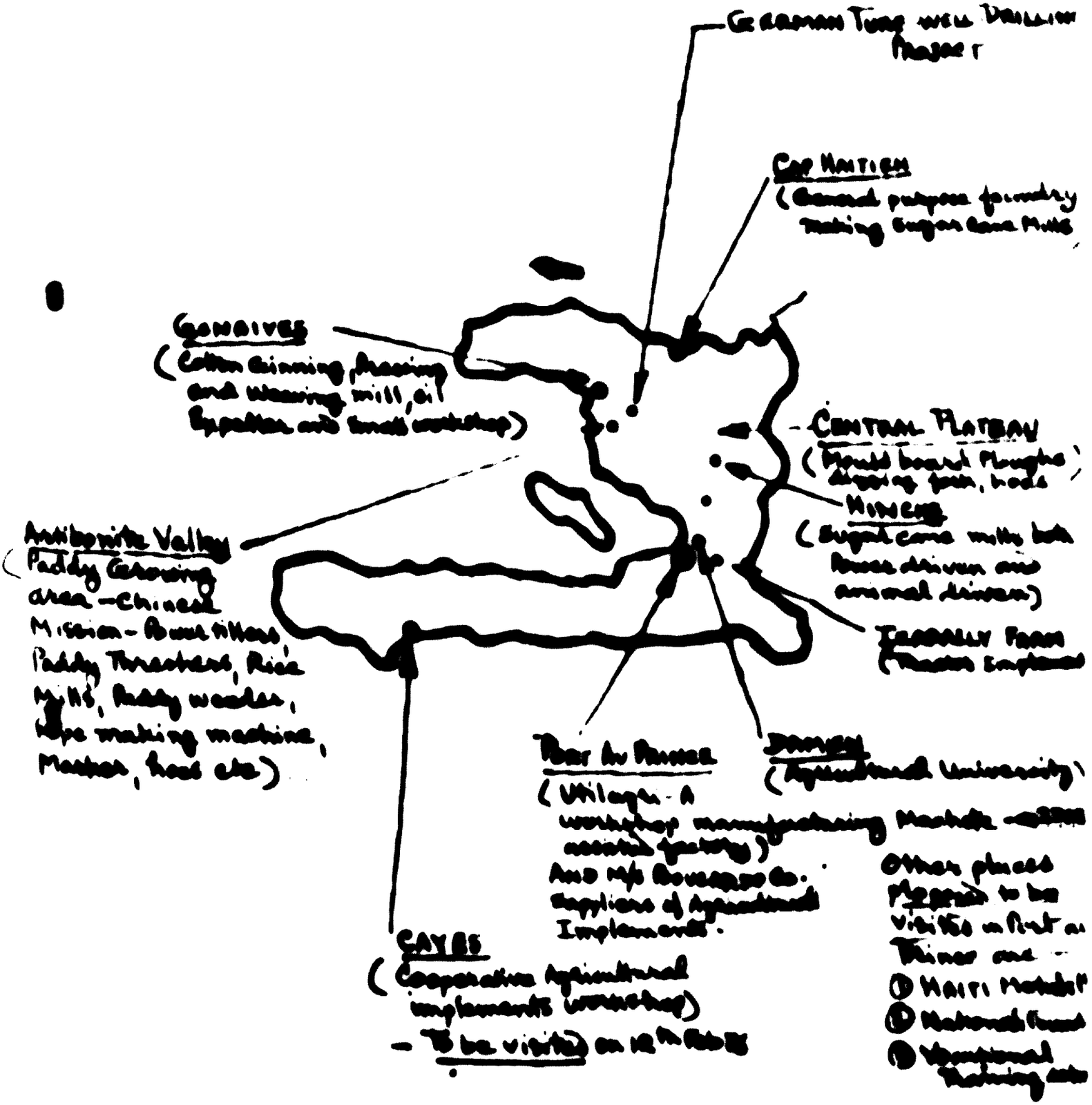


Fig. 54 - SITES VISITED.

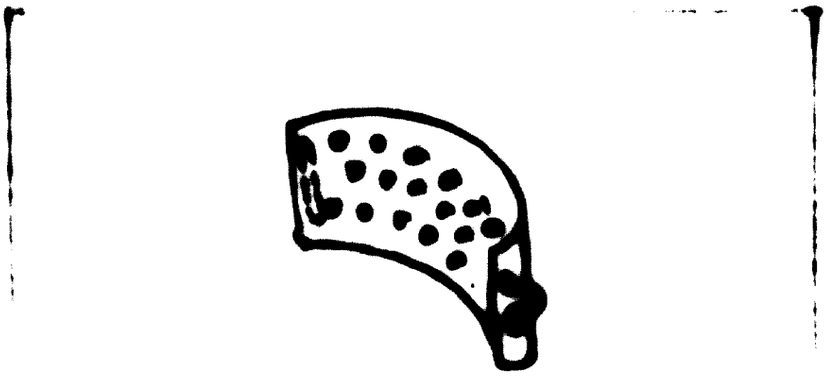


FIG. 55 - HAITIAN MAIZE SHELLER.

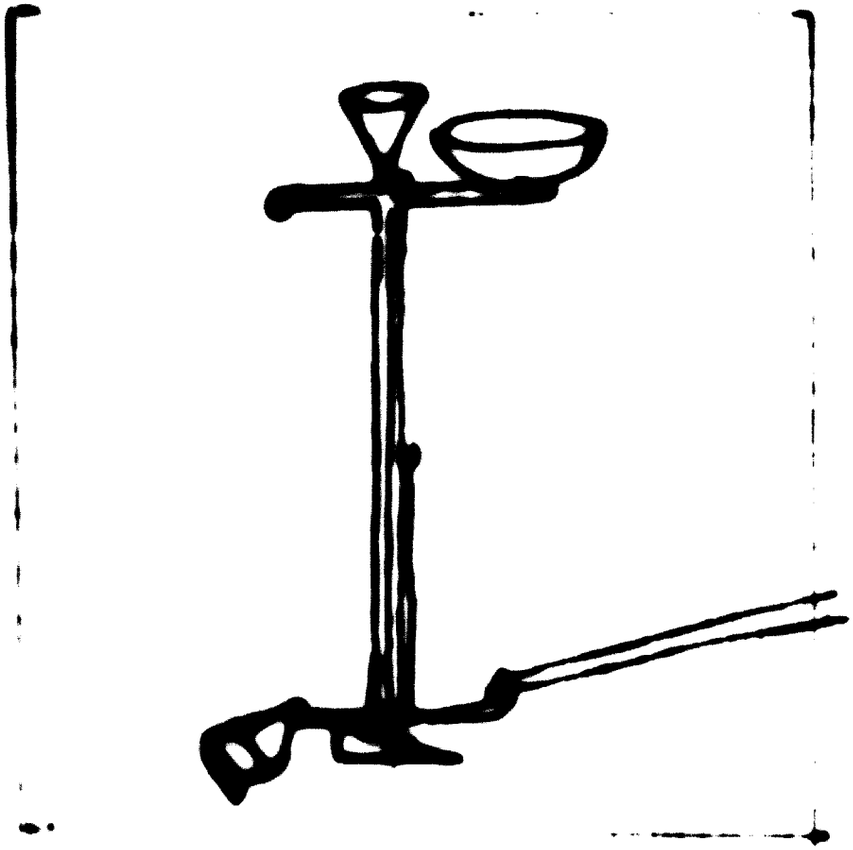


FIG. 56 - HAND SEED DRILL FOR HAITI

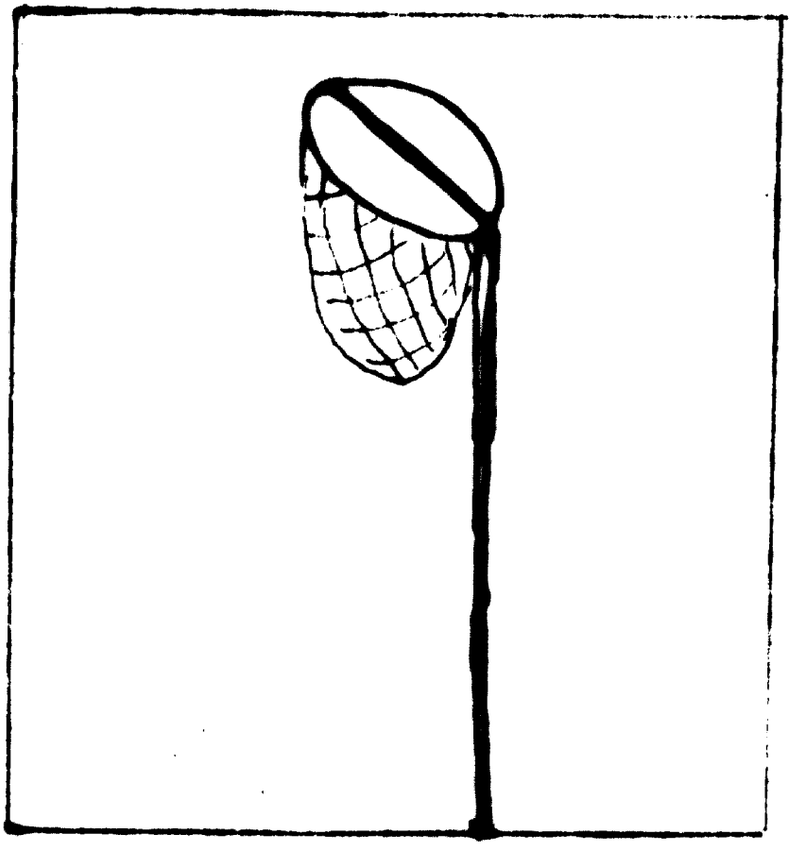


FIG. 57 FRUIT PLUCKER

FIG 58 Puis Chiche (Horse Gram)

- Cicer Arietinum - leaves pod and grain approximately natural size

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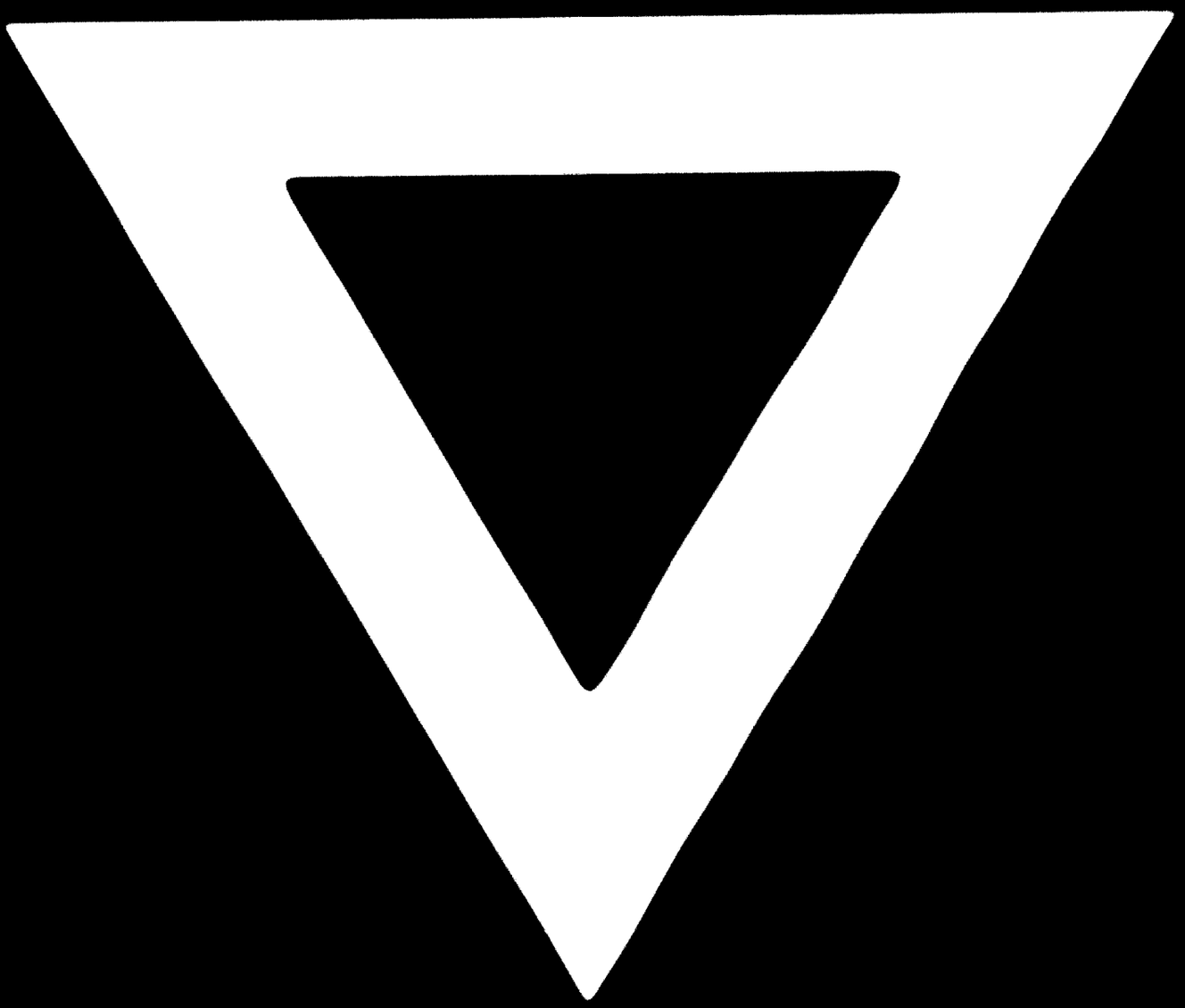

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