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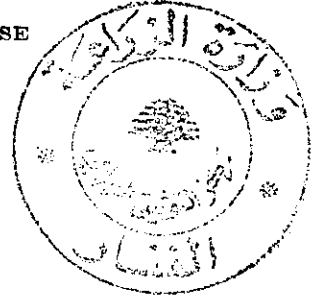
COMMENTS ON TERRACE CONSTRUCTION IN LEBANON

Votre réf.
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S U M M A R Y

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APPENDICES:

- Nomograph for estimating soil depth requirements and maximum terrace widths.
- Nomograph for estimating dimensions and quantities for terraces.

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S U M M A R Y

1. Areas to be terraced should be carefully selected, based on soil survey and other physical characteristics.
2. Training in topographic surveying and design of terraces should begin immediately.
3. Terraces should be constructed according to a pro-determined plan with adequate supervision provided.
4. Terraces should be finished to tolerances that will allow them to be efficiently irrigated. Grade stakes should be set for final finishing.
5. Rocks and stones should be removed from the field before beginning terrace construction.
6. Combinations of equipment should be tried.

R E S U M E

1. Les terrains destinés à être aménagés en terrasses devraient être soigneusement choisis, sur la base d'une étude du sol et d'autres particularités physiques.
2. Il faudrait commencer de suite l'entraînement dans les levés topographiques et la projection des terrasses.
3. Les terrasses devraient être construites, selon un plan établi à l'avance et faire l'objet d'une surveillance adéquate.
4. Les tolérances à admettre dans la finition des terrasses devraient permettre une irrigation efficace. Contrôler le profil final avec des mires.
5. Les rochers et pierres devraient être enlevés du terrain avant de commencer la construction des terrasses.
6. Il faudrait essayer des équipements combinés.

COMMENTS ON TERRACE CONSTRUCTION IN LEBANON

INTRODUCTION

The Green Plan has ambitious plans for the construction of new terraces in all parts of Lebanon. It is anticipated that many of these terraces may eventually be irrigated either from water furnished by the Litani Authority, other proposed national irrigation schemes, or by ground-water pumping where this is found feasible. It has not been established where these irrigated areas will be. It is important, however, even at this time, to construct all new terraces in such a manner that they may be efficiently irrigated in case water is made available in the future. Even if water does not become available terraces constructed to irrigation standards will function to a high degree of efficiency under dry land farming conditions.

Initial construction work has pointed up some problems which are in need of further study. Seemingly, the major problem is one of rock and stone removal. This problem, however, must be related to the more basic one of proper site selection. In their desire to get work started, work is being accepted nearly anywhere a willing landowner is found. Very little, if any, consideration is presently being given to the physical land characteristics.

SITE SELECTION

The importance of the selection of areas to be terraced cannot be overemphasized. This selection should be made on the basis of soil type, including soil depth, amount of rockiness and/or stoniness, slope and drainage patterns. Two projects in the UNSF-FAO are presently making soil surveys in Lebanon; the Forestry Project and the Soil Survey and Related Irrigation Schemes Project. Some preliminary soil studies made by other organizations are also available. Where soil survey data does not exist or where it is inadequate, a special investigation of the site is certainly in order.

When the actual physical conditions of a site are known it is then possible to make decisions concerning the acceptance or rejection of a particular area, and the information is valuable in designing the terrace system.

LAYOUT AND DESIGN

Generally, before any physical land improvements are begun, detailed topographic surveys are made. This survey is then correlated with the soil survey information and a balanced design for the earth moving is made. This design may also serve as a reasonable guide concerning the cost of the proposed work.

These surveys and designs are not presently being made in Lebanon. This is partially due to the absence of trained people. It also appears partially due to the failure of officials to appreciate their value and their reluctance to spend the time required for such surveys. It has been proven time and time again throughout the world that this type of planning is indispensable if acceptable results are to be obtained. Serious consideration should be given now to the training of people in the field of topographic surveying and terrace design. Simply starting the tractor driver out and allowing him to build terraces by eye cannot insure the end product desired. Admittedly, the physical conditions of the land in question will dictate the intensity of the survey that is needed. For example, in very steep rocky areas it may be impractical to attempt to design balanced cuts and fills as the quantity of rock removed may constantly upset the designed balance. It would be practical, however, to have enough topographic and soils information to allow the designer to determine the location, alignment and width of the terraces.

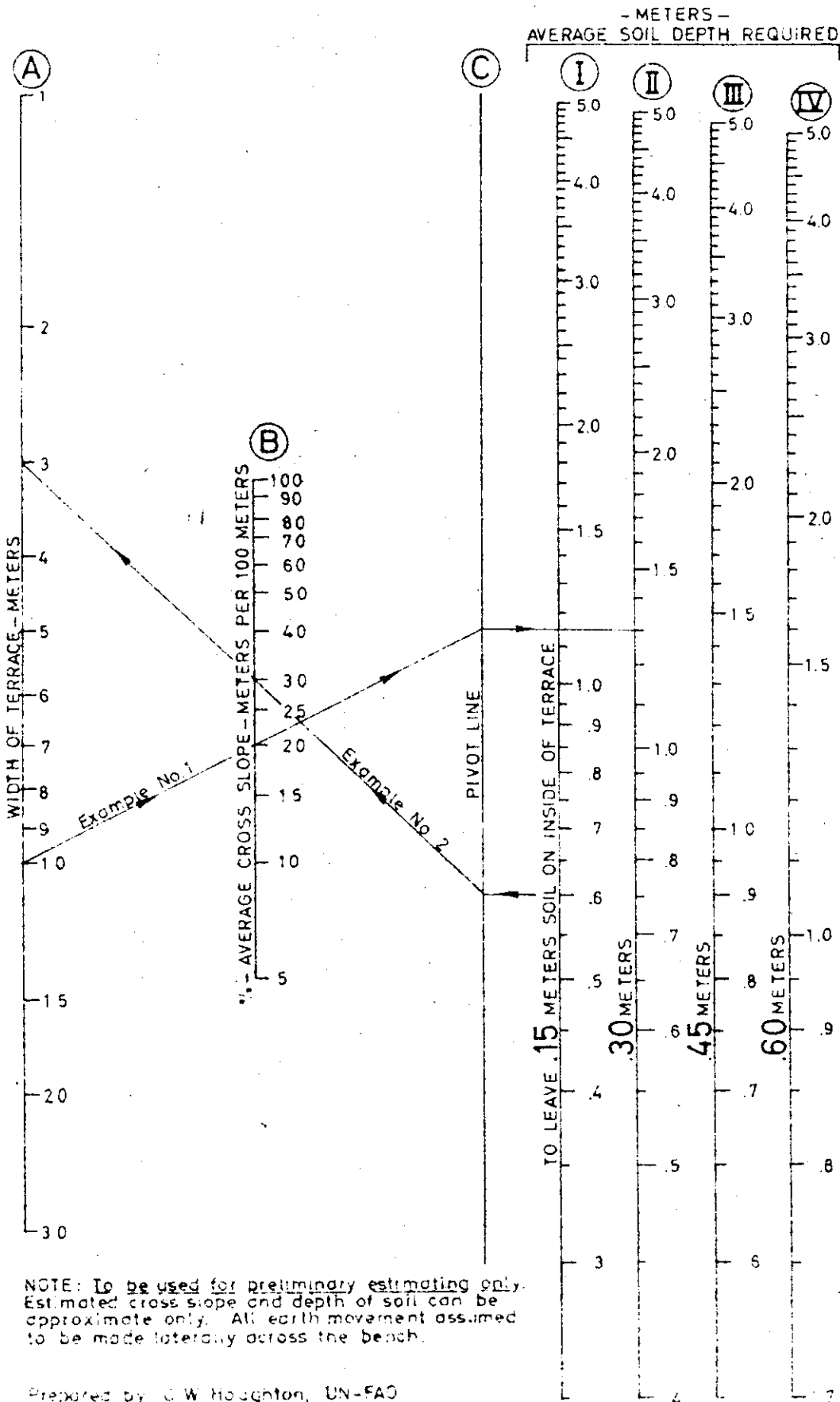
There is a very important relationship between soil depth, slope of the land, and the width of the terraces. (Refer to the attached nomographs.) A knowledge of these relationships along with a knowledge of the other physical land relationships mentioned earlier, will enable the planner to select sites and design terraces which will be economically and physically practicable. There is no need to build terraces where, after they are completed, the soil is of insufficient depth or quality to sustain crop growth.

CONSTRUCTION AND SUPERVISION

During the construction phases it is important to have a trained supervisor at the construction site. He should direct the work of the tractor driver according to pre-developed plans. He should be equipped with at least a hand level. Before leaving a terrace, grade stakes should be placed so that the terrace may be finished to a uniform slope. This is very important, and is simply and quickly done with a minimum of training. The finished condition of the terraces now built is generally quite poor. In their present state it would be impossible to irrigate them without first bringing in another tractor or considerable hand labor.

NOMOGRAPH

FOR ESTIMATING SOIL DEPTH REQUIREMENTS AND MAXIMUM TERRACE WIDTHS



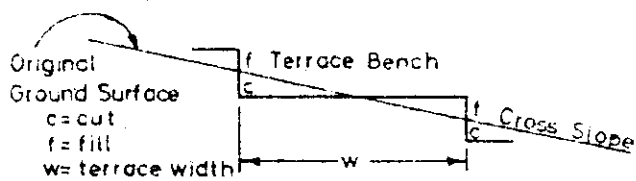
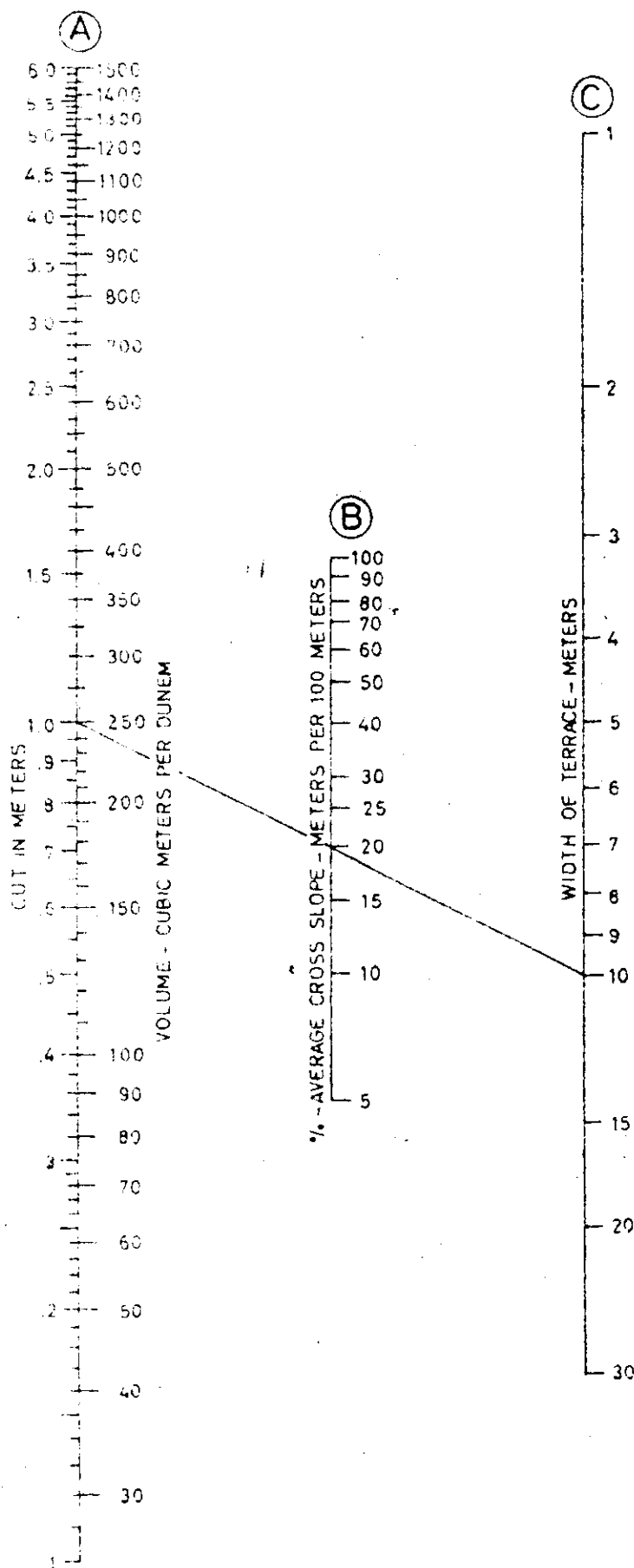
NOTE: To be used for preliminary estimating only. Estimated cross slope and depth of soil can be approximate only. All earth movement assumed to be made laterally across the bench.

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EXAMPLE NO. 2:
 GIVEN: A soil depth of 6 meters and 30% cross slope
 FIND: terrace width when 15 meters soil depth is desired on inside of terrace.
 SOLUTION: Enter scale (I) at 6 meters, extend line horizontally to pivot line (C) and then through 30% in scale (B) to 3 meter terrace width on scale (A)

EXAMPLE NO. 1:
 GIVEN: A cross slope of 20% and a desired terrace width of 10 meters. FIND: depth of soil required in order to leave 15 meters soil on inside of terrace.
 SOLUTION: Enter scale (A) at 10 meters, extend line through 20% in scale (B) to pivot line (C). Extend line horizontally to 1.5 meters soil depth required in scale (I)

NOMOGRAPH FOR ESTIMATING DIMENSIONS AND QUANTITIES FOR TERRACES
AND TO ILLUSTRATE RELATIONSHIP BETWEEN SLOPE, WIDTH OF TERRACE, DEPTH OF CUT, AND VOLUME OF EXCAVATION



NOTE: To be used for preliminary estimating only. Estimated cross slope of ground can only be approximate. Estimated quantity of excavation does not allow for shrinkage of earth fill nor any end movement of earth. All earth movement assumed to be made laterally across the bench from cut to fill.

EXAMPLE:
GIVEN: A cross slope of 20% and a terrace width of 10 meters. Find depth of cut and cubic meters excavation per dunem.
SOLUTION. Enter scale (C) at 10 meters, extend line through 20% in scale (B) to 250 cubic meters per dunem in scale (A), and a cut of 1.0 meters in scale (A).

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