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Second Interregional Fertilizer Symposium

Kiev, USSR, 21 September - 1 October 1971  
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CONCLUSIONS AND RECOMMENDATIONS

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.

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## CONCLUSIONS AND RECOMMENDATIONS

### I On future symposia to be organized by UNIDO

#### Conclusion 1

The Second Interregional Fertilizer Symposium clearly conveyed the technical, economic and agricultural possibilities of developing the fertilizer industry in the countries of the participants. It helped in transfer of technology and the discussions clarified many questions pertaining to the industry.

#### Recommendation 1

An interregional fertilizer symposium should be held every three or four years. This time lag between the meetings is the maximum considering the rapid changes in technology and in the economics of fertilizer production and its use in agriculture. Preferably, the symposium should divide the participants into major groups on technology, marketing, agriculture, financing, etc., and the duration should not be more than two weeks and the venue restricted to one host country.

### II On technology of production of ammonia and nitrogen fertilizers

#### Conclusion 2

Based on the technology, currently used world-wide, and the experience gained, only the most economic-size ammonia plants should be built in developing countries.

#### Recommendation 2

Developing countries with large markets for nitrogen fertilizers, e.g. 100,000 tons N per year or more, should give serious consideration to building nitrogen fertilizer plants in sizes of 150,000 tons N per year or larger and avoid uneconomic investments in plants smaller than this.

#### Conclusion 3

Urea and ammonium nitrate are the two leading nitrogen fertilizers both are suitable for various crops and soils.

#### Recommendation 3

Developing countries should compare carefully the relative merits of urea and ammonium nitrate to meet their basic need for nitrogen fertilizer, considering the relative production costs in the particular country and the

pattern of crops. (Urea and ammonium nitrate are the only two realistic choices for meeting the basic needs for nitrogen fertilizer in most developing countries, although ammonium chloride, ammonium sulphate, ammonium phosphates, calcium nitrate, and anhydrous ammonia may be supplementary sources of nitrogen in many cases.)

### III On technology of production of phosphate and potash fertilizers including mixed, complex and liquid fertilizers

#### Conclusion 4

Wherever large internal or export markets for phosphate fertilizers exist, viable economic-size phosphoric acid plants should be built for smaller markets, import of phosphoric acid may be more economical. Production and distribution of fertilizers containing all three plant nutrients N, P + K should be encouraged. The economics of production and use of liquid fertilizers are attractive.

#### Recommendation 4

Developing countries with large markets for phosphate fertilizers, e.g. 80,000 tons  $P_2O_5$  per year or more, should give serious consideration to building phosphoric acid plants in sizes of 100,000 tons  $P_2O_5$  per year or larger, followed by conversion of phosphoric acid to ammonium phosphates or triple superphosphate.

#### Recommendation 5

Developing countries should produce and distribute NP and NPK fertilizers, wherever the market is large enough to warrant indigenous production, rather than continuing the more traditional practice of producing and distributing N, P, and K fertilizers separately.

#### Recommendation 6

Developing countries should give consideration to the production and use of liquid fertilizers (including anhydrous ammonia, aqua ammonia, nitrogen solutions, NP solutions and NPK solutions) as alternatives to the more traditional solid fertilizers.

#### Recommendation 7

UNIDO, in co-operation with FAO, should establish one or more pilot demonstration projects in selected developing countries for the production, storage and application of liquid fertilizers and bring the results to the attention of all developing countries.

#### IV On technology of production of nitrophosphate fertilizers

##### Conclusion 5

Several new processes for the production of nitrophosphates with varying degrees of water solubilities have been developed and based on which commercial units have been built which are operating satisfactorily.

These processes are particularly appropriate when a country has a present or potential supply of ammonia but does not have an indigenous supply of sulphur. The economic benefits can be quite significant in some cases.

##### Recommendation 8

Many developing countries could advantageously utilize the new nitrophosphate processes for the production of NP or NPK fertilizers.

#### V On fertilizer intermediates and the concept of satellite plants

##### Conclusion 6

It has been established that primary nutrients, nitrogen (N) and phosphates (P), can be produced very economically at the location where large sources of cheap raw materials like gas and phosphate rock and/or sulphur, exist. Well-proved and economic bulk carriers have been developed for water transport of both ammonia and phosphoric acid.

##### Recommendation 9

Developing countries with medium-sized markets for fertilizer should give consideration to the importance of ammonia, urea, phosphoric acid and/or ammonium phosphates to use in "satellite plants" for the production of NP or NPK fertilizers, as an alternative to primary production of ammonia and/or phosphoric acid. The "satellite plant" concept is indicated for countries having a market for nitrogen fertilizer from 20,000 to 100,000 tons N per year and/or a market for phosphate fertilizer from 10,000 to 80,000 tons  $P_2O_5$  per year.

##### Recommendation 10

Developing countries with markets for fertilizer, smaller than those cited, in the preceding recommendation, should probably import finished fertilizers, with or without simple mixing operations for production of NP and NPK mixed fertilizers.

VI On raw materials for fertilizer production

Conclusion 7

Gaseous and liquid hydrocarbon raw materials for the production of ammonia are the most economic in certain areas of the world and processes based on them are easy to operate, the supply of other raw materials like phosphate rock, potash and sulphur are adequate to meet the demand of industry on a world-wide basis. The price of sulphur has largely stabilized in the world market.

Recommendation 11

Developing countries which have indigenous supplies of gaseous or liquid hydrocarbon materials, should, of course, utilize these feedstocks for the production of nitrogen fertilizers, but developing countries which do not have these materials should give consideration to the use of coal or lignite as feedstocks, along with thorough analysis of all alternatives.

Recommendation 12

UNIDO should make a study of the ammonia plants based on coal and lignite, throughout the world, in order to evaluate the capital costs and production costs (including maintenance costs) of such plants as a guide to developing countries.

Recommendation 13

UNIDO should assist developing countries in making decisions in the choice of raw materials, particularly for ammonia production, in view of the complex nature of such decisions.

Recommendation 14

UNIDO should assist developing countries in conducting surveys to locate new sources of raw materials for the fertilizer industry, particularly phosphate rock, sulphur and potash, utilizing the most modern and sophisticated techniques.

Recommendation 15

Developing countries should give increased attention to bulk unloading and internal shipping of fertilizer raw materials such as phosphate rock, potash and solid and molten sulphur. The same applies to fertilizer intermediates such as ammonia, urea, phosphoric acid and ammonium phosphates. UNIDO could assist the developing countries in this respect.



VII On design, construction, operation and maintenance  
of fertilizer plants and pollution control

Conclusion 8

On an average, the fertilizer plants in developing countries operate much below design capacity. Lack of proper and timely maintenance is one of the major factors. Removing bottlenecks and bringing existing units to full capacity must be given highest priority. Assistance as needed in this effort should be sought from bilateral or international agencies. Developing countries which plan to build additional number of plants have a chance to develop design and equipment and spare parts manufacturing facilities. Problems of environmental pollution exist during production processes in fertilizer plants and the use of products in agriculture.

Recommendation 16

Most developing countries need to increase the percentage output of existing fertilizer plants which frequently operate at 40 to 70% of design capacity on an annual basis. Operation at 90 to 100% of capacity should be the goal. Frequently, this will require additional investment for "de-bottlenecking" and equipment modifications.

Recommendation 17

Most developing countries should improve the maintenance of existing fertilizer plants. Poor maintenance is probably a major factor in production below rated capacity now being realized in many plants in developing countries.

Recommendation 18

The larger and more advanced developing countries should make plans to produce an increasing amount of the equipment needed for the construction of new fertilizer plants and also spare parts and other materials needed for maintenance of existing plants.

Recommendation 19

The World Bank and other international lending agencies should establish special loan programmes for developing countries to assist them in "de-bottlenecking", improved maintenance and indigenous production of fertilizer plant equipment.

Recommendation 20

All countries, including the developing countries, should give increased attention to designing and operating fertilizer plants with a minimum of environ-

mental pollution by gaseous, liquid or solid effluents.

Recommendation 21

UNIDO should proceed with the proposed "global project" for UNLF financing on the effect of manufacture, distribution and use of chemical fertilizers on the environment and the control of pollution therefrom.

VIII On planning, financing and economics of new fertilizer plants

Conclusion 9

Financing agencies require more and more comprehensive feasibility and pre-investment studies before assessing new projects or expansion of existing production facilities before investment.

Recommendation 22

Most developing countries should improve their preparation of project reports requesting loans from the World Bank and other sources of loan funds. UNIDO could assist the developing countries in preparing better project reports with more precise economic data and evaluation.

Recommendation 23

The World Bank and other lending agencies should give a higher priority to loans for the fertilizer industry in developing countries than has been true in the past in view of the rapidly increasing demand for fertilizers in these countries.

Recommendation 24

Developing countries should not underestimate the potential contribution of private capital, both domestic and foreign, to the development of their fertilizer industries.

IX On training of production and marketing personnel

Conclusion 10

Training of personnel for production and maintenance and for marketing of fertilizers is inadequate in many developing countries.

Recommendation 25

Most of the developing countries need to give greater attention to the training of both production and marketing personnel in the fertilizer industry.

### Recommendation 26

Developing countries which are more advanced in development of the fertilizer industry, such as Arab Republic of Egypt, India, Republic of Korea and Mexico, could be of great assistance to other developing countries in the training of production and marketing personnel.

## X On marketing and distribution of fertilizers

### Conclusion 11

Institutional frame-work and physical facilities for marketing and distribution of fertilizers are inadequate in many developing countries.

### Recommendation 27

Most developing countries need to give much greater attention on the marketing of fertilizers in order to develop the demand for fertilizers commensurate with the true economic need for fertilizers. This will involve the setting-up of more efficient distribution systems, education of farmers, training of marketing personnel, provision of credit to farmers, pricing policies and other factors.

## XI On use of fertilizers in agriculture

### Conclusion 12

Pre-investment studies and projects for the use of fertilizers have been carried out successfully by FAO. In many developing countries they have proven that fertilizer use raises production, is economical and acceptable to farmers. It is necessary to continue these programmes and to strengthen them by the assistance of government, non-governmental agencies and private enterprises. The emphasis on field demonstration and extension work, fertilizer distribution and credit schemes must be continued.

High yielding varieties have been proven to be most effective when used together with other agricultural inputs as fertilizers, pesticides and good water and farm management techniques. In a number of cases no provision has been made by the countries concerned to develop the infrastructure necessary to supply the inputs and to organize the marketing channels for the added production.

Valuable work has been done by the plant physiology institutes in the Ukrainian SSR in experiments and soil testing methods as well as in the develop-

ment of fertilizers containing micro-elements derived from ore residues. With increased yields, the use of improved varieties and other agricultural inputs, the micro-element deficiencies are becoming more and more important in agriculture.

The use of liquid fertilizers together with solids and particularly the application of aqua and anhydrous ammonia has been found most economical in some of the developed countries. The demand for this fertilizer material is growing rapidly.

The field experiments carried out in Japan on the use of nitrate fertilizer on rice, as well as the studies in West Pakistan, have proven the agronomic benefits of its use in certain conditions.

The need for potassium as an ingredient in balanced fertilization has been demonstrated in many areas of developing countries and its use has proven economically beneficial to the farmer. With more frequent cropping and higher yields, it becomes imperative to review the response to potash together with nitrogen and phosphate by long-term experiments at frequent intervals. In all FAO fertilizer projects the role of potassium is tested the same way as nitrogen and phosphate.

Models for the use of computers to assist in planning agricultural production and inputs have been developed by many national and international bodies. FAO within the last three years has developed a computerized soil data processing system and it is in the course of preparing systems for storage, analysis and evaluation of soil data with special reference to fertilizer use and related soil improvement.

#### Recommendation 28

Developing countries planning to utilize the new high-yielding varieties (HYV) on a large scale should make plans for adequate supplies of fertilizers as well as increased irrigation, pesticides and agricultural machinery.

#### Recommendation 29

Most developing countries need to give greater attention to a more balanced ratio for the main plant nutrients - N, P, K, - in relation to the increasing use of high-yielding varieties and improved methods of cultivation.

#### Recommendation 30

UNIDO and FAO, as appropriate, should make a joint study of the needs for secondary and micro-nutrients in the developing countries in which these arise and develop techniques for incorporating the necessary secondary and micro-nutrients in commercial fertilizers.

Recommendation 31

Developing countries in which rice is a major crop should not be too dogmatic regarding the use of nitrate fertilizers on paddy cultivation but should be guided by realistic cost benefit analyses comparing nitrate fertilizers with urea and other non-nitrate nitrogen fertilizers.

Recommendation 32

UNIDO and FAO should collaborate to collect information about computer models developed by some countries to assist the marketing, distribution and use of fertilizers in agriculture and make such computer models available to the developing countries on request.

XII On problems facing the future development of the industry  
in developing countries

Conclusion 13

On the basis of an analysis of the replies received to the questionnaire sent out by UNIDO, the important problems are:

- (a) high cost of production from existing plants,
- (b) high capital cost of new plants,
- (c) lack of engineering and fabrication facilities;
- (d) shortage of foreign exchange and/or credit for imports;
- (e) competition in exports;
- (f) low prices of farm products.

Recommendation 33

Urgent steps should be undertaken by developing countries to bring existing units to full production, thereby lowering the cost of production (see also recommendations 16 and 17).

Recommendation 34

Thorough and realistic studies of internal and external markets and prospects for sales and related elements should form the basis for priorities of investments in new fertilizer projects. Fiscal and agrarian policies of the governments should promote fertilizer production and use.

XIII On the role of national and international organizations in helping the developing countries meet their fertilizer needs during the 1970's.

Conclusion 13

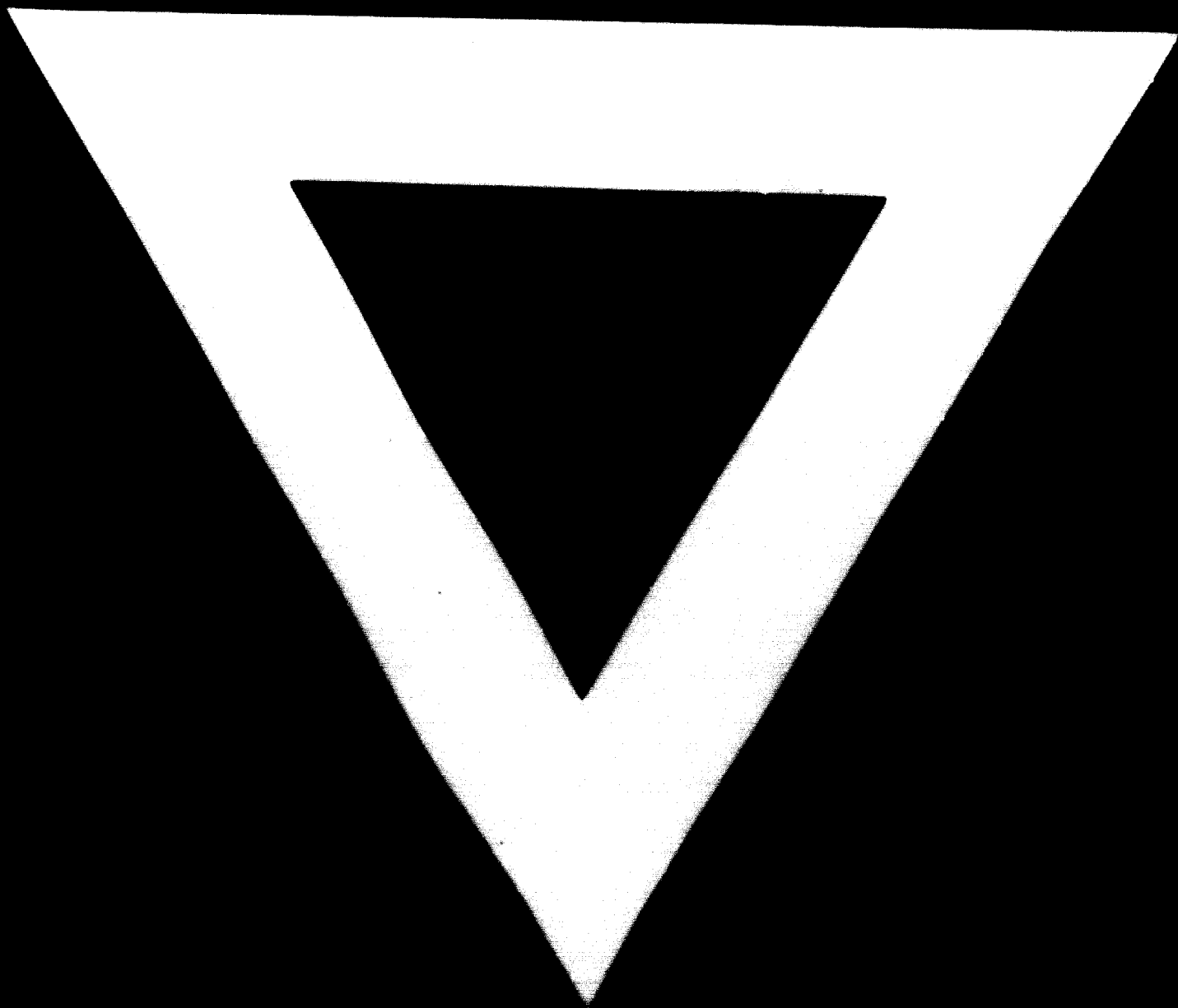
Developing countries have realized that the experience gained by national and multinational enterprises as well as international organizations in assisting setting-up regional fertilizer production facilities and the infrastructure for use of indigenous raw materials and marketing of products will be of great value to them. Assistance from international organizations in the choice of processes, product-mix, etc. will be valuable to countries in the early stages of planning fertilizer projects.

Recommendation 35

UNIDO should take the initiative, in collaboration with the World Bank, FAO, ECA, ECAFE, ECE, ECLA and UNESOB, in promoting the development of regional schemes for the production and distribution of fertilizers in order to utilize most effectively the raw materials available in various regions and to make fertilizers available to all countries at lowest cost.

Recommendation 36

UNIDO should assist developing countries in making decisions in the choice of processes to use in production of fertilizers as well as in the choice of raw materials (see also recommendations 11, 12, 13 and 14). These are very complex decisions which require information and advice from many sources.



**10.7.74**





