INFORMATION AND REPORTS

SUBNETWORK ON SUNFLOWER APPLIED GENETICS

REPORT

on the working meeting held at the Institute of Field and Vegetable Crops, Novi Sad, Yugoslavia (4—8 November 1980)

The activity of the research subnetwork on sunflower applied genetics started in 1978 when the first working meeting took place at its liaison centre of Prague.

The second working meeting of Novi Sad was attended by the following participants : Prof. Dr. A. Kováčik and Dr. V. Skaloud (Ruzyné — Prague, Czechoslovakia), dr. G. Piquemal (Montpellier, France), dr. A. V. Vrânceanu (Fundulea, Romania), dr. D. Skorić, Mr. M. Mihaljčević and Mr. R. Marinković (Novi Sad, Yugoslavia).

Prof. Dr. A. Kováčik, co-ordinator of this subnetwork, presented a report on the scientific activities of the subnetwork in the last two years and made a proposal for a joint investigation in the subsequent period. The activities of the subnetwork comprised the following topics :

1. Quantitative genetics of agronomic characters ;
2. Genetics of pollen sterility, fertility restoration and disease resistance ;
3. Genetics of marker characters ;
4. System of information exchange of the results of genetic research.

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The work on genetic studies on sunflower agronomic characters conducted so far has been discussed at the meeting and plans were made for the subsequent work. A network of experiments shall be established at several locations on the basis of diallel crossings performed and F_1 and F_2 combinations produced. The experiments should provide information on the mode of inheritance in F_1 and F_2, manifestation of heterotic effect, components of genetic variance, dependence on and effect of environmental factors.

First results of the joint study initiated in 1978

The initial stage of this study includes the establishment and evaluation of an international experiment with test hybrids.

a) yield components in each geographical region involved ;

b) optimum combination of yield components for different geographical regions ;

c) adaptability and stability of yield components in the genotypes used ;

d) variability range of genetic parameters in different environments and localities.

The experimental material was prepared in 1979 and 1980. The experiment itself will commence in 1981—1982.

The initial material is made up of seven sunflower inbred lines used in diallel crosses to obtain experimental hybrids of F_1 and F_2 generation. The lines are characterized by good combining ability, full fertility and phenotipic uniformity.

The following table (Table 1) shows some of the main characters of the parental lines : mark and origin of the line, number of days to 50% flowering, plant height in cm, resistance to *Plasmopara helianthi* as % of attack.

Table 1

Line mark and origin	Flowering	Height	Resistance to *P. helianthi*
GR-8, Romania	76	94	up to 10%
HA-5-4-3, Yugoslavia	76	132	15—20%
D-34-2-10, France	75	134	15—20%
CPK-34, France	80	128	10—15%
P-32, Spain	79	138	15—20%
N-6/4, Yugoslavia	88	178	up to 10%
B-777-43, Spain	72	117	up to 10%

The factors to be treated in the experiment refer to genotypes, locations, and years.

The genotypes are assumed to be represented as follows :

7 parental lines
21 F_1 hybrid combinations
21 F_2 hybrid combinations
1 hybrid, NS-H-33, as control
1 varietal population, Peredovik, as control.

The factor of year will comprise the years 1981 and 1982.

The factor of location should comprise, in an optimum case, six test sites, forming quite a dense and regular network on the territory of southern and central Europe. Experiments will be conducted in three replications in Novi Sad (Yugoslavia), Fundulea (Romania), and Prague (Czechoslovackia), in one replication in Montpellier (France), Clermont-Ferrand (France), and Córdoba (Spain).

The experiment will be established in all countries after a uniform method. It is assumed that the experiment will be arranged in replications. In each replication, each of the genotypic variants should be represented by 40 plants suitable for evaluation. The plants will be sown following conventional agricultural practices of the region of growing. The growing density should be 50,000 plants/ha. Sowing date should be the same as the normal sowing date for the geographical region in question. The technology of growing should comply with local habits. The harvest should not be influenced by desiccation. It should be performed manually, with additional seed drying.

The following characters will be evaluated per replication :

No. of leaves (10 plants)
Stem height (10 plants)
Stem diameter (10 plants)
Head diameter (10 plants)
No. of seeds formed per head (5 plants)
Self-fertility (5—10 plants)
Seed yield per plant
Seed yield per hectare
1,000 seed weight
Hectoliter weight
Husk percentage
Oil content in seed
Days to budding (75%)
Days to flowering (75%)
Days to physiological maturity (75%).

The evaluation will also cover the occurrence of diseases.

For the determination of the decisive yield components in different geographical regions, the multiple regression principle will be used.

At the first stage of the procedure, the number of multiple regressions between a complex trait and its components will agree with the number of test locations. The number of independent variables x_i, will correspond to the number of partial traits hich are involved in the realization of the complex tratit. It can be assumed that the values of regression coefficients x_i, related to the components of a complex trait, would be different for each location.

At the second stage of the procedure, the significance of the calculated regression coefficients will be tested. The partial traits with significant regression coefficients in each equation will be included in the calculation of the definite regression equation, the others will be left out. This is the reason why each location may be characterized by a different number of yield components and by their different structure. When the number of traits is reduced, it is necessary to calculate again all multiple regressions (now with different numbers of independent variables) whose regression coefficients will be significant.

It can be found from the equations which traits are decisive in different locations for yield formation and, thereby, which of them are most interesting from the standpoint of breeding.

The determination of the optimum combination of yield components for different geographical regions lies in a gradual incorporation of data from the set of hybrid generations in regression equations, worked out for each location ; at the first stage of the procedure, partial coefficients between the pairs of traits will be calculated for each location, these pairs being components of a complex trait. The significance of the coefficients of correlation will mark those traits between which partial coefficients of regression are to be determined.

The second stage of the procedure may be shown through the following example :

For a location the regression equation :

$y = a + b_1x_1 + b_2x_2 + b_3x_3 = b_4x_4$ was determined.

For x_1, introduce the maximum value of the first component occurring in the genotypes in the given location. For traits which are not in correlation with the first component, also substitute the maximum value found in the given set.

For the traits which are in partial correlation with the first component, calculate the value corresponding to the data substituted for x_1, using partial regression coefficients. Having introduced all values of x_1 obtained in this way, in the regression equation, the first value of the complex trait y_1 is obtained, as determined at the maximum value of the first component. An entirely analogical procedure is adopted when inserting the second component and, step by step, the remaining components. This will give such number of values of a complex trait as the number of variables represented in the respective equation.

The maximum value of a complex trait can be regarded, in a certain sense, as the calculated ideotype, attainable in the given location and at the given genetic potential of the parental lines used. Besides showing the possibilities of a certain set of genotypes, the result of this analysis also indicates the component whose maximization through breeding will enable, in the test location, the quickest achievement of the highest yield (this is an original procedure, prepared by Kováčik and Škaloud).

In evaluation of the adaptability and stability of the levels of the yield components of the phenotypes used, structural relation analysis will be used (K e n d a l l, S t u a r t, 1975), using the values of a highly adaptable genotype as the independent variable (L a n g e r, 1978).

Using the mentioned analysis, the two control variants of the experiment (the Peredovik cultivar and NS-H-33 hybrid) will be compared with the experimental hybrids in 12 different environments (6 locations $\times$ 2 years). The stability of the level of each yield component for all genotypes involved can be evaluated on the basis of the difference of the line slope of the structural relation between the value of the control and the respective genotype from 1.00. The over-all analysis can be complemented by separate calculations for a zonally limited extent of environment.

Besides evaluating the stability of the values of yield components, the evaluation of the variability and stability of some genetic parameters of these traits can also be made. In particular, this would involve the GCA of the lines used for the given trait (G r i f f i n g, 1956), the heritability of yield components, estimate of the proportions of the additive and dominant variability components in the realization of the respective trait studied (H a y m a n, 1954). It is very probable that the stability of these parameters will vary in different traits, depending on environmental conditions represented by the broad network of the locations involved.

Programme of co-operative work for the next 4 years

It was decided to investigate the heredity of the main agronomic characters in order to be able to design new ideotypes for different environments. The following groups of characters were selected, each participanting country having to study a limited number of model characters (Table 2).

The option for studying the heredity of model characters has been made taking into account the available genetic lines in sunflowers germplasm collection of each participating country. For completing the set of gentic lines needed for this study, the Liaison centre of Prague will organize the adequate germplasm exchange within the genetic subnetwork.

After the separate study of the heredity of model characters, the genotypic and phenotypic correlations among these characters will be studied in a second stage, with the aim to establish the possibility of their integration in a final morphological and physiological ideotype able to assure the highest seed and oil yields in a given environment.

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The programme on the identification and study of new sources of *cms* and pollen fertility restoration has been developed mainly in

Table 2

Model characters	Country in charge *)
a) **Characters of the head**	
— diameter	Romania
— shape	Romania
— thickness	Romania
— position	Czechoslovakia
— insertion	—
b) **Seed characters**	
— seed set per head	—
— empty seeds, central and dispersed	Romania & Czechoslovakia
— size and weight	—
— husk thickness and ratio husk: kernel	Czechoslovakia
— oil and protein content	—
c) **Stem characters**	
— height and diameter	Yugoslavia
— no. of internodes	Yugoslavia
— terminal branching	Yugoslavia & France
— lodging and breaking	Yugoslavia
d) **Leaf characters**	
— no. of leaves	Yugoslavia
— size, shape, and insertion	Yugoslavia
— position	Yugoslavia & France
— pubescence	Yugoslavia
e) **Stages of growth**	
— germination and emergence	Czechoslovakia
— budding	Czechoslovakia
— flowering	Czechoslovakia
— physiological maturity	—
f) **Self-fertility**	France

*) Vacant position in the column "Country in charge" will be filled through a co-operative work of the Liaison centre in Prague, Czechoslovakia, and the interested institutions from other European countries.

France and Yugoslavia. In France, Dr. P. Leclercq investigated the variability in the expression of male sterility. He concluded that the cytoplasm "coriace" is difficult to be restored and therefore is practically unimportant. Gundaev's cytoplasm does not ensure entirely male sterile progenies in spite of large efforts exerted in finding good maintainers. On the other hand, studies on Anaschenko's cytoplasm *(lenticularis)* seem to give encouraging results.

A new source of *"petiolaris"* cytoplasm was obtained and efforts are presently being made to determine whether it is a new type of cytoplasm or not.

Male sterile plants were obtained in Montpellier by Dr. G. Piquemal by crossing *H. argophyllus* and *H. annuus*.

For the next research period, it was decided to accomplish the following tasks :

a) a detailed survey of all *cms* sources which could be used in sunflower breeding. A collection of all *cms* sources will be established in Clermont-Ferrand.

b) a study of the stability of different *cms* sources in different ecological conditions. This study will be co-ordinated by the Plant Breeding Station in Clermont-Ferrand.

c) a study of cytological and histological variation of different *cms* sources. The study will be carried out at Ruzyné, Czechoslovakia and Fundulea, Romania.

d) a detailed survey of sources and genes for pollen fertility restoration. The survey will be co-ordinated by the Research Institute for Cereals and Industrial Crops of Fundulea, Romania. A collection of restorers will be established in Fundulea and the interaction with different environments will be studied.

e) concerning the genetic studies of disease resistance, the work will be based on the investigation of downy mildew *(Pl. halstedii)* and broomrape *(O. cumana)*. For this, a collection of genetic differentials will be established in Novi Sad, Yugoslavia.

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The Liaison center in Ruzyné, Czechoslovakia, in co-operation with Fundulea, Romania, and Novi Sad, Yugoslavia, has already established a comprehensive collection of marker genes. In the next period, the co-operating institutions will continue with the characterization of the existing markers, the final aim being the establishment of genetic linkages as the basis of a future genetic map. The Liaison center will continue to collect other genes existing in the genetic nurseries of the participants and will issue a catalogue of marker genes for the help of other scientists. The available marker genes will be then distributed to all solicitors.

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A promising start was made in the exchange of information concerning results, achievements, and publications in the field of sunflower genetics. The Liaison center will continue the efforts to intensify this co-operation.

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Besides the discussions on the above topics, the participants in the meting examined also the activity of **the subnetwork on wild sunflowers.**

The activities of this subnetwork started in Montpellier and Novi Sad in 1980. Fifty samples of different wild species were received by Montpellier Research Station which started an investigation concerning the taxonomy as well as first tests for resistance to white rot *(S. sclerotiorum)*. Novi Sad Institute established a collection of wild species with samples received from the United States, France, Bulgaria and Romania. All wild species have been crossed with domesticated sunflowers. Besides, morphological characters of wild species heve been described and observation on disease resistance made.

The collecting of additional wild species started also in 1980 in order to gather as much as possible of the existing wild species. Mr. Luka Ćuk from Novi Sad was sent to the United States on this errand. The visit was organized through USDA. Se far, he has collected over 400 samples.

In the next period, the following topics will be studied co-operatively by Yugoslavia, the U.S., France, Romania, and Bulgaria.

1. Determination of morphological and botanical characters, to complete the basic data on wild sunflower species.
2. Determination of agronomically important characters in order to increase the genetic variability of breeding materials.
3. Testing the wild species for resistance to diseases and insects. Comparative tests should be performed in the United States and several European countries in order to determine pathogenic populations and races.
4. Determination of the degree of self-fertility in wild species.
5. Further studies on the possibilities of crossing wild species with domesticated sunflowers.
6. Testing the possibilities of crossing wild sunflowers among themselves.
7. Determination of new sources of male sterility and restorer genes in wild species.
8. Use of wild species in the breeding for high protein content and certain oil quality (high contents of linoleic acids, tocopherols etc.).
9. Determination of marker genes in wild species.
10. Possibility of using wild species for the development of new ideotypes of cultivated sunflower.

The participants in the Novi Sad meeting agreed to have the next meeting of the subnetworks on sunflower applied genetics and wild sunflowers in Montpellier, France, in the first decade of November, 1982.

SUBNETWORK ON SUNFLOWER DISEASE MAPPING IN EUROPE

REPORT

on the mission in Hungary, Bulgaria and Romania in August 1980 *

MILIVOJE ACIMOVIC
Liaison centre of Novi Sad, Yugoslavia

In Hungary I visited the Cereal Research Institute in Szeged and its experimental field in Kiszombor. Dr. F. Viranyi from Plant Protection Institute from Budapest met me at the border and accompanied on my entire tour through Hungary. I visited the following experts, institutes and experimental fields in Hungary : Research Institute for Fodder Crops, Iregszemcse (Dr. E. Kurnik), Experimental fields at Bacsalmas (Dr. P. Bekesi, Dr. F. Viranyi, and Director of the Field and his associates), Institute for Plant Protection, Budapest (Dr. F. Viranyi).

In Bulgaria, I visited the Institute for Wheat and Sunflower, General Toshevo (Dr. P. Petrov, Dr. I. Georgieva, Pepa Stoyanova-Shindrova, A. Canov).

In Romania I visited the Research Institute for Cereals and Industrial Crops, Fundulea (Dr. H. Iliescu, N. Pîrvu).

In Hungary, Dr. A. Mesterhazy from Szeged Institute is in charge of the sunflower disease mapping programme. I did not meet him because he was on vacation at the time of my visit. As far as I know he does not work on sunflower diseases but on wheat diseases. So far he has not written a single report for the FAO programme. In view of this situation, I asked Dr. F. Viranyi from Plant Protection Institute and Dr. P. Bekesi from Varietal Commission to help the programme of disease mapping. We discussed and agreed upon what they are to do. Each one of them received the methodology of disease evaluation. They had classifield superbily the bibliography of papers on sunflower diseases published in Hungary. I sincerely hope that they will be of much help in further realization of the programme.

I found the situation in General Toshevo, Bulgaria, even worse. Mrs. Rossitza Bochvarova, a phytopathologist in charge of sunflower disease mapping, has left the Institute. She moved to Sofia to work at the Horticultural Institute and abandoned her work on sunflower diseases. Nobody was in charge of the programme for over a year ; a few months ago, Mrs. Pepa Stoyanova-Shindrova was appointed to work on the programme. She had worked on harmful insects of sunflower but since the diseases are more important she switched to them. She is young and ambitious and I hope she will get the work on sunflower diseases mapping going. As R. Bochvarova has not left any written materials sent to her from FAO, I had to leave all I had with me and explain what to do. Later on I sent to her some papers on sunflower diseases. She would like to visit Novi Sad for 15 to 30 days to become acquainted with the work on sunflower diseases. I promissed to welcome her whenever she is allowed to come.

I also met P. Petrov and I. Georgiev, breeders, and A. Canov, Vice-Director of the Institute. The first two colleagues familiarized me with their work on sunflower breeding and Mr. Canov promised a more intensive co-operation of their Institute with FAO.

I was greeted warmly at Fundulea Research Institute for Cereals and Industrial Crops, in Romania, where dr. H. Iliescu and N. Pîrvu explained to me details of the work conducted at the Institute. It was a short but successful visit which helped me become thoroughly acquainted with their work.

The programmes are very good but I noticed some shortcomings. The major three parasites, *Plasmopara helianthi, Sclerotinia sclerotiorum,* and *Botrytis cinerea* are mostly studied while the other diseases are merely registered. That is not good. The three parasites are important but not the principal causes for yield reductions. Last year, as well as this one, in Yugoslavia, the other parasites caused larger damages than the above three. We had epiphytotics of

* Scientific information is given in the preceding paper "Occurrence of sunflower diseases in Bulgaria, Romania, Hungary and Yugoslavia".

wilting at the stage of seed filling. Roots, stems, and leaves were attacked and over 90% of plants ended the vegetation period prematurely which brought considerable reductions in yields and oil percentage. Some parasites which caused the epiphytotics are known but some are not, at least for the present. I am working intensively on this serious problem. I believe that problems are common in Central Europe, Romania, Hungary, Bulgaria, Yugoslavia, and it would be reasonable to try to solve them co-operatively. There will be no safe sunflower production before we solve these problems.

SOUS-RÉSEAU DÉSHERBAGE CHIMIQUE

RAPPORT

de mission en Yougoslavie, Roumanie et Hongrie du 7 au 16 Juillet 1980

Y. REGNAULT
CETIOM Paris, France

Le but de ce voyage était de visiter les essais de désherbage chimique actuellement en cours, de discuter les méthodes pour les harmoniser et d'envisager l'avenir de cette coopération avec les responsables de la lutte contre les mauvaises herbes des différents Instituts visités.

YOUGOSLAVIE : Institut pour les Cultures de Champ et Maraîchères de Novi Sad, 8 et 9 Juillet.

Avec Monsieur Z. Kosovać nous visitions les essais de désherbage concernant le tournesol. La coopération avec la Yougoslavie est maintenant bien rodée et les méthodes utilisées tout à fait correctes : dispositifs expérimentaux, méthodes de notations, etc.

Il faut signaler qu'une conception unique guide les essais aussi bien sur tournesol que maïs ou soja : les produits de prélevée sont les plus travaillés —et utilisés dans la pratique en grande culture — et ce sont des combinaisons d'un antigraminées (Dual ou Lasso) plus un antidicotylédones (une triazine à dose réduite : actuellement le Bladex, souvent complétée par une urée telle le métobromuron ou le linuron) qui permettent les meilleurs résultats. Ces produits sont appliqués à trois variétés différentes de tournesol pour en vérifier les réactions. Il semble donc que des solutions satisfaisantes existent pour lutter contre les adventices les plus fréquentes: *Chenopodium, Amaranthus, Anagallis* et *Solanum nigrum* par exemple visibles dans l'essai visité.

Un nouveau thème d'étude est pris en compte à Novi Sad, celui de la sensibilité variétale des hybrides et de leurs lignées parentales aux herbicides les plus fréquement employés en cultures. Mais, paradoxalement, les doses doubles — ou plus élevées encore — ne sont pas testées dans cet essai. Il est vrai que sa surface est déjà très importante mais il aurait sans dout été préférable de réduire les niveaux de l'un des facteurs (variétés ou produits) de façon à connaître plusieurs points de la courbe de réponse biologique des hybrides aux différents produits.

Enfin, un essais de vérification des phénomènes de glissement de flore vient d'être mis en place sous une rotation maïs-tournesol-blé, dont les observations se poursuivront pendant six ans au moins.

Pour Novi Sad donc, aucun problème actuellement. La poursuite de cette coopération intéresse certes Monsieur Kosovać, mais il semble que les exigences particulières à cet Institut évoluant vers davantage de précision dans les réponses aux problèmes très spécifiques rencontrés, ce soit surtout par des échanges de résultats et de méthodes d'essais que cette coopération sera fructueuse. Par exemple, le fait de privilégier les produits de prélevée qui ici donnent de bons résultats, supprime toute recherche concernant les produits de postlevée, dont la mise au point intéresse vivement d'autres Instituts.

Les problèmes de pathologie du tournesol ont été évoqués avec le Professeur Aćimović et ceux de sélection pour la résistance aux maladies avec Monsieur D. Skorić et Monsieur M. Mihaljcević.

ROUMANIE : Institut de Recherche pour Céréales et Plantes Techniques de Fundulea, 11 et 12 Juillet.

Une réflexion du Dr. N. Şarpe peut résumer son optique de recherche sur les herbicides du tournesol : il faut aller vers la mise au point de produits de présemis complets.

Nous avons visité en la compagnie du Dr. A. V. Vrânceanu et du Dr. N. Şarpe les trois essais mis en place à Fundulea.

Le premier essai, inspiré du protocole que j'ai adressé aux différents instituts participants, illustre bien l'impossibilité d'un protocole commun : toutes les doses indiquées dans mon protocole ont du être largement augmentées pour tenir compte de la teneur en matière organique du sol, plus élevée en Roumanie qu'en France. Le Dr. N. Şarpe a toutefois eu le mérite de garder certains produits à la dose indiquée, à titre de référence pour les autres pays.

Aucun produit n'est satisfaisant dans cet essai. Le second essai mettait en comparaison différents herbicides de prélevée ou présemis puis prélevée, mais la longue période de sécheresse après le semis a retiré toute efficacité aux produits de prélevée. Constat a été également fait que, dans les terres de Fundulea, certains nouveaux produits doivent être

utilisés à une dose 10 fois supérieure à celle indiquée par la firme pour avoir une efficacité correcte.

Le troisième essai apporte des résultats intéressants par des mélanges de produits appliqués en présemis avec une partie antigraminées et un complément original antidicotylédones. Das cet essai, la maîtrise des *Sinapis, Echinochola, Setaria, Amaranthus* est complète, il ne reste que quelques *Convolvulus arvensis.*

En marge de ces essais, une application du nouvel antigraminées de post levée de I.C.I. maîtrise parfaitement *Sorghum halepense* de rhizomes.

A la suite de cette visite, un échange de vues en présence du Dr. A. V. Vrânceanu aboutit pratiquement aux même conclusions qu'à Novi Sad. Il faudra donc mettre au point cette cooperation entre chercheurs au niveau des méthodes et de l'échange des résultats : j'ai fortement insisté pour que des questions précises soient posés à l'ensemble des participants du sous-réseau chaque fois que l'un d'entre nous aborde un problème nouveau pour lui.

HONGRIE : Institut de Recherche des Plantes Fourragères de Iregszemcse, 14 et 15 Juillet.

Monsieur J. Fodor, responsable de l'éxpérimentation herbicide me fait visiter l'essai mis en place en 1980 avec des herbicides, soit de présemis complétés par des produits de prélevée, soit de prélevée en mélange. C'est l'un de ces mélanges qui maîtrise le mieux la flore présente : *Panicum, Setaria, Sinapis, Ambrosia elatior* et *Polygonum lapathifolia,* devançant quelque peu le produit de référence commun du réseau : Tréflan en présemis puis linuron en prélevée.

Le contexte hongrois est un peu particulier, en ce sens que l'Institut Central de la Protection des Plantes qui ne participe pas à notre réseau est le fournisseur obligatoire des produits à expérimenter. D'autre part, bien qu'à l'affût des nouveautés, l'Institut d'Iregszemcse estime que les résultats actuels sont satisfaisants avec les herbicides utilisés en grande culture. D'autres thème pourraient être abordés, tels la sensibilité variétale, la compétition réelle des différentes espèces, l'utilisation raisonnée des herbicides au cours de la rotation des cultures, etc.

J'ai également visité l'Institut de Szeged, mais malheureusement il n'y a pas de spécialiste des herbicides à cet Institut.

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En conclusion, cette mission m'a permis de constater un excellent niveau de technicité des recherches entreprises, assez nettement supérieur à ma précédente visite. Je pense essentiel de pouvoir tenir une réunion de tous les spécialistes des Instituts participants pour mettre au point la Banque de données (à informatiser) et harmoniser les méthodes utilisées sur de nouveaux sujets.

Redactor : ILEANA MUREȘAN
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Dat la cules : 27.02.1981. Apărut : 1981. Tiraj : 400 ex. Coli de tipar : 7,5.

Lucrare executată sub comanda nr. 453 la Oficiul Economic Central „Carpați", Întreprinderea poligrafică „Bucureștii-Noi", str. Hrisovului nr. 18 A, sectorul 1, București