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RSCRE Meeting Report

Soybean Genetics Newsletter

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Research on Soybeans for Cooler Regions of Europe
Meeting at Eischikon near Zürich, 3./4.8.1981

Notes on the meeting:

1. Introduction

Prof. E. R. Keller chaired the meeting and welcomed the participants. He specially mentioned Dir. M. Arnoux, chairman of the FAO-Soybean Network, Prof. Dr. G. Röbbelen, chairman of the Oil and Protein Crops' Section of EUCARPIA and Prof. Dr. W. D. Beversdorf, Univ. of Guelph (Canada), at present time guest scientist in the Crop Science Dept. at Zürich. Both organizations suggested to organize this meeting and the aim should be to: create a working group of specialists which, based on already available experience, should 1) encourage better cooperation in research, and 2) continue research on the adaptation of the soybean plant to cooler regions in Europe.

2. List of participants

Canada
Dr. W. D. Beversdorf, Dept. of Crop Science, Univ. of Guelph, Guelph, Ontario, N1G 2W1

England
Mr. S. Houghton, ADAS, Ministry of Agriculture, Fisheries and Food, Great Westminster House, Horseferry Road, London SW1P 2AE

France
Mr. M. Arnoux, Ecole Nat. Sup. Agron., Dir. Stat. d'amélioration des Plantes, F-34060 Montpellier-Cedex
Mr. A. Vidal, Station d'amélioration des Plantes INRA, F-34060 Montpellier-Cedex

Federal Republic of Germany
Miss I. Kübler, Justus Liebig Universität, Institut f. Pflanzenbau u. Pflanzenzüchtung, D-6300 Giessen (Prof. Dr. W. Schuster)
Prof. Dr. G. Röbbelen, Institut f. Pflanzenbau u. Pflanzenzüchtung, V.-Siebold-Strasse 8, D-34 Göttingen
Dr. J. F. Seitzer, Dir. Inst. f. Pflanzenzüchtung, KWS Kleinwanzlebener Saatzucht, D-3352 Einbeck
Dr. A. Tékété, Univ. Hohenheim, Institut f. Pflanzenbau u. Pflanzenzüchtung, Postfach 106, D-7 Stuttgart 70 (Prof. Dr. G. Kahnt)
A. Adetoro, Univ. Hohenheim, Institut f. Pflanzenbau u. Pflanzenzüchtung, Postfach 106, D-7 Stuttgart 70

Poland
Prof. Dr. J. Szyrmer, Plant Breeding and Accclimatization Institute, IHAR, Radzikow near Warsaw, 05-870 Blonie

Sweden
Mr. R. Elovson, Holmbergs Utsaeden, Fiskeby, S-605 90 Norrköping
3. Papers presented


A. Vidal: Soybean research and breeding program in INRA - Montpellier.

J. F. Seitzer: Adaptation of soybeans to the growing conditions of Western Europe.

J. Szyrmer, A. K. Szczepanska: Screening of soybean genotypes for cold tolerance during germination.

W. D. Beversdorf and D. J. Hume: Cold tolerance research in soybeans.


W. D. Beversdorf and D. J. Hume: Future effects for soybean improvement in Ontario, Canada.

R. Elovson: Soybean breeding in Sweden. II. Plans for the future.

A. Vidal, M. Arnoux: Proposals for a cooperation program "Adaptation of the soybeans to cooler regions."

A. Soldati, E. R. Keller: Considerations on future research activities.

H. D. Voldeng: Short season soybean program.

Summary: Discussion of the position of soybean research for cool regions of Europe (the full text of all papers was made available to all participants prior to the meeting).

Considerable time was devoted to establishing the current position of soybean research in the cooler regions of Europe. Objectives of the programs were consistent to the extent that all programs are attempting to increase yield and yield stability. Specific goals and approaches of the breeding programs varied considerably.

In France, Mr. Vidal reported that efforts are concentrated on developing group I and II soybean cultivars with improved drought tolerance for non-irrigated production areas and varieties with improved lodging resistance and reduced leaf area for irrigated fields. For the northern half of France, early varieties are required that have productivity characteristics of midwest American varieties combined with cold tolerance characteristics of the Swedish varieties. In the Paris-basin the introduction of the soybean into rotations rich in cereals would be appreciated. A yield level of 2.5 t/ha (South) or 2 t/ha (North) is considered as competitive. In Montpellier, a cooperative effort with private companies and ENSAT was initiated in 1981 using a recurrent (3-year) selection scheme to develop adapted early soybean material.
In Poland soybean research has an old tradition. Soybeans are included in the National Plant Protein Research Program. Professor Szyrmer indicated that soybean breeding is concentrating on very early maturing (000-type) determinate material. Improved seedling emergence at low temperatures is a primary goal of the research and breeding efforts as well as improved quality characteristics related to human consumption of soy-protein products. In his breeding program he is working with the pedigree method as well as with mutagenesis. He emphasizes the necessity of physiological research work.

In Sweden, Mr. Elovson reported that breeding efforts are centered on improved yield and harvestability, and improved emergence at low temperatures. Sweden, like Poland, is concerned primarily with improvement of 'Fiskeby V' maturity material. Mr. Elovson indicated that improved lines may be available commercially in two years. He does not have a definite opinion in relation to the preference of determinate or semideterminate types.

Dr. Seitzer of the Federal Republic of Germany reported that yield and yield stability, cold tolerance during pod filling, resistance to Pseudomonas glycinea and improved seed quality are required in cool regions of Europe. Dr. Seitzer suggested that, while considerable genetic variability exists for yield improvement, variability for earliness and cold tolerance is somewhat limited.

Dr. Soldati of ETH, Switzerland, placed emphasis on the need to establish an ideotype for cooler regions. He indicated that agronomic practices, genotype and the environment all have a major influence on the development of the soybean plant and that the interaction of these basic sources of variation results in considerable variation of plant development from year to year and location to location. Dr. Soldati indicated that improved cold tolerance, particularly during flowering and pod filling, was necessary in early varieties for cooler regions of Europe.

Dr. Beversdorf of Ontario, Canada, suggested that temperature variation from year to year during critical developmental stages for soybean has led to yield and maturity instability in many cooler regions. He suggested the need to evaluate the natural environmental variability within each region of potential soybean production from historical weather data and the response of genotypes to this variation as the first step in defining requirements of adapted varieties and selection criteria that will ultimately lead to stable and adapted varieties for cooler regions of Europe.

The general approach to breeding improved varieties for cooler regions varied considerably among institutes, from mutation breeding and pedigree advance in Poland, to modified single-seed descent advance and recurrent selection schemes in France. The concept of cold tolerance also varied considerably among institutes from emergence at cool temperatures in Poland and Sweden to podding ability at low temperatures in West Germany and Switzerland. Evidence of the independence of specific cold-tolerance traits provided in the position papers resulted in general agreement that current varieties may have some cold-tolerant characteristics (e.g., ability to emerge at low temperatures) while lacking others (e.g., ability to set pods at low temperatures).

The relationship of photoperiod sensitivity and temperature on the duration of vegetative and reproductive stages was also discussed. There was general agreement that these relationships need further evaluation across the diverse ranges of photoperiods and climatic conditions of Europe. The North
American maturity system does not appear to adequately define maturity adaptation of varieties in cooler regions of Europe, particularly in regard to the very early groups (Group 0 and 00 of the North American system).

Discussion of desired plant types regarding termination of vegetative growth (degree of indeterminate habit) was discussed but conclusions varied. The desirability of a determinate habit with regard to uniform maturation was offset by the desirability of the indeterminate habit regarding recovery from stress (cool temperatures or leaf diseases) during critical early reproductive stages and harvestability. There was agreement that soybean has excellent ability for total biomass production in cool regions, but that instability in partitioning biomass between vegetative and reproductive growth was a problem. This partitioning is related to both temperature-photoperiod interactions and podding ability following cold stresses during early reproductive development, and therefore is subject to the highly variable environment of cooler regions of Europe. Genotypes with increased stability in this regard would facilitate development of agronomic practices that consistently provide maximum performance.

Priority areas of soybean - Research and cooperative efforts

Several participants provided suggested areas of research that might assist in the adaptation of soybean to cooler areas of Europe. General agreement on the need to evaluate the photoperiodic and temperature responses of current varieties led to the formation of a cooperative trial of a standard set of early cultivars across much of the cooler regions.

In order to allow integration of the results of these trials, minimum data collection criteria were established, as follows:

a) Daily minimum and maximum temperatures will be provided from the date of planting until maturity.

b) Daily or weekly precipitation will be recorded.

c) Precise latitude and elevation of the trial locations will be provided, as well as soil type.

d) General agronomic practices including seeding rate, row width and planting depth and date will be provided.

e) Final emergence of plant density will be provided.

f) The date of R1, R3, R5, R7 and R8 (according to the system proposed by Fehr and Caviness, 1977) will be recorded as precisely as possible (see discussion of the system below).

g) The date of the first killing fall frost will be recorded if any variety in the trial has not achieved R8 by that date.

h) The date and type of any unusual weather or environmental event that might affect measurements of adaptation (hail, epidemic, nutrient deficiency, lodging due to wind storms, etc.) will be recorded.

i) The trial will include a standard set of 8 to 10 early varieties subject to availability of quality seed. Seed will be distributed by Dr. Soldati, ETH.

j) The cooperative trial will be conducted by participants for a minimum of two years beginning in 1982.
k) Other data to be collected by cooperators include: Yield (g/m²), lodging (0 = no lodging to 5 = completely lodged), height (cm) and 1000-seed weight).

Several suggestions for other areas of cooperative research were proposed. Variation among institutes and availability of resources led to the conclusion that cooperation would be at the discretion of individual research groups. The priority areas identified included:

a) Evaluation of the current extent of variability for specific cold tolerance traits, early flowering and early maturity and estimating the heritability of desirable characteristics.

b) Assessment of the need for and potential benefits from a potential FAO-sponsored collection of early material from North Japan, North China and the Eastern USSR some time in the near future (in this regard, a subcommittee was established to evaluate the currently available sources of very early maturing entries in various germplasm collections; Dr. Seitzer, responsible with Prof. Beversdorf, Mr. Elovson, Prof. Szyrmer and Mr. Vidal).

c) Exchange of breeding materials (i.e., from SSD programs and material that appears productive but out of the specific area of adaptation for which the originating program is concerned).

d) Exchange of early maturing sources of resistance to Pseudomonas glycinea.

e) Evaluation of the effects of different planting dates within locations for lengths of developmental stages for the standard set of cultivars used in the cooperative trial above.

f) Evaluation of the responses of the standard set of cultivars (above) to different controlled photoperiods and different controlled temperatures with regard to duration of critical developmental stages (Ve to R₁, R₃ to R₅, and R₅ to R₇), in order to establish ratings on photoperiod sensitivity which could be compared with estimates deducted from the cooperative trials.

Discussion on identification of growth stages:

Considerable variation in collection of data regarding the stage of development of soybean was apparent from institute to institute. In order that data from cooperative trials may be combined in developing models of soybean adaptation, the group decided to use the system proposed by Fehr and Caviness, 1977. A copy of the proposed system will be provided to participants of the cooperative trials (subject to permission of the authors) by Dr. A. Soldati.

Future activity

The participants elected Dr. A. Soldati as chairman of the working group. We will contact the different research institutes and ask them whether or not they wish to join the working group. He will serve as a coordinator for the above mentioned program and initiate it.

W. D. Beversdorff
A. Soldati
E. R. Keller