

Genetics and Breeding Cooperatives for Horticultural Crops

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Attention here will be confined to those non-profit groups that serve to exchange information and materials related to genetics and breeding of specific horticultural crops. Being independent of the formal scientific societies and having arisen electively according to demand, they are highly heterogeneous in regard to functions, organization, support, and even titles. In most respects this heterogeneity is commendable since the needs of the various groups differ, and each group develops a distinctive character. It is beyond the scope of this article to present all the details of each cooperative, but they will be compared in respect to the most important aspects of their structure and functions. I hope to avoid an excessive slant toward the *Tomato Genetics Cooperative*, with which I have been associated since its inception. Excluded from major consideration in this article are groups devoted exclusively to line testing (ex. *Southern Tomato Exchange Program*, STEP), those covering an entire crop group (e.g. *Vegetable Improvement Newsletter*, VIN; *Small Fruit Workers*, SFW), or those which are restricted regionally.

The origin of the genetics-improvement cooperatives traces back to 1932, when the *Maize Genetics Cooperation* (MGC) was founded by R. A. Emerson, his colleagues, and students. In the preceding years maize geneticists held informal annual meetings, which were very successful and led to the establishment of the MGC. The organization of the *Drosophila Information Service* (DIS) soon followed. To a large extent the patterns set by these highly successful pioneers have been adopted by the many subsequently organized groups. Both the maize and drosophila groups started as stock maintenance and distribution centers as well as clearing houses for information of mutual interest. But

with the increasing magnitude of the former responsibility and the impracticability of managing both tasks in the same organization, or even accommodating both at the same institution, neither cooperative serves any longer as a stock center. To a large extent, the same holds for other cooperatives.

Among horticultural crops, the genetics-improvement cooperatives have flourished to the greatest extent in the vegetable species. Fruit species are represented by the *Apple Breeders Cooperative* (ABC), *Grape Breeders Conference* (GBC), *National Peach Breeders Conference* (NPBC), and *Pear Breeders Cooperative* (PBC). Vegetable crops are already represented by the *Bean Improvement Cooperative* (BIC), *National Cooperative Carrot Breeding Program* (NCCBP), *Crucifer Improvement Cooperative* (CIC), *National Lettuce Workshop* (NLW), *National Sweet Corn Breeders Association* (NSCBA), *Pisum Genetics Association* (PGA), *Tomato Breeders Round Table* (TBRT), and *Tomato Genetics Cooperative* (TGC). My treatment will deal mainly with these horticultural groups, although where appropriate I shall refer to cooperatives for other species.

Organization

Formalities of organization are usually held to the minimum necessary to carry out the intended functions of the cooperatives. In most groups an executive or coordination committee serves in an advisory capacity, but geographic limitations require that the bulk of the decisions and direction of the work, or often the work itself, falls on the shoulders of the chairman. Such committees are made as representative as possible of geographic regions, segments of the industry, and areas of research prevalent in the cooperative. Other committees may be appointed as needed for such purposes as nomenclature rules, linkage, stock, etc.

Activities

The cooperatives fall into two categories in respect to their main function: they may largely achieve their

objectives (1) at annual meetings or (2) via newsletters. If both media are used as in the BIC, the complete transactions of the meetings are not documented. The meeting pattern is followed by the NPBC, SFW, NCCBP, CIC, NLW, NSCBA, and TBRT, while the newsletter receives major emphasis in the BIC and TGC. It is of interest to note that, although two cooperatives exist for tomatoes, their functions do not overlap, partly because the Breeders Round Table (TBRT) stresses meetings, while the Genetics Cooperative (TGC) stresses the newsletter and partly because their primary interests differ. The advantages and disadvantages of both systems will be considered in the following sections. Certain cooperatives, notably the ABC, have also developed an extensive program for testing new selections.

Meetings

All of the listed cooperatives hold annual or biennial meetings, whether strictly for business affairs or for discussion of research and other items of mutual interest. Those of the former type are held in conjunction with national meetings of a scientific society or group of societies, while the latter usually meet independently. Since participants tend to divulge their results and thoughts more freely if they are not recorded in print, the discussion meetings - - usually lasting for one or two days - - often permit a more fluent exchange of facts and ideas. On the other hand, such meetings are mainly of benefit only to those members who can attend, and recent financial limitations on travel have restricted attendance at national meetings. Certain groups (NCCBP, CIC, NLW) prefer to meet at times and places of commodity production and testing, and the merits of such scheduling do not need elaboration.

Newsletters

As previously observed, certain cooperatives rely mainly on comprehensive newsletters to provide for the intended exchange of information and stocks. These publications, usually annual, vary

¹The assistance of Dora G. Hunt with editing and of Dr. M. M. Rhoades and other colleagues with information concerning various cooperatives is gratefully acknowledged.

considerably in format. They may be mimeographed, reproduced by offset, or they may be printed from set type, as in the elegant products of the *Wheat Information Service* (WIS). Items usually included are research reports, summaries of selection or line evaluations, stock exchange lists, varietal pedigrees, bibliographies of recent literature, lists of members' projects, gene lists, linkage summaries, membership lists, and financial statements.

The real meat is found in the research notes and stock exchange lists. The former consists of brief summaries of research results of a preliminary nature or restricted area of interest, for which no other outlet usually exists. Descriptions of new mutants, reports of new linkages, the development of new techniques, and breeding of useful lines comprise the bulk of the subjects. When major contributions of interest to a wider scientific audience are submitted, they are usually referred to appropriate technical journals for publication.

Certain precautions must be observed in the dissemination of information in the newsletters. The interests of the contributors must be protected lest they withhold their observations. An investigator may prefer not to have his results publicized beyond the confines of the cooperative. Thus a statement requiring permission from the respective writers for citation of their contributions by others is commonly made in the newsletters. As far as I am aware, this regulation is seldom violated. Most of the articles are of such a nature that their writers generally approve citations.

This consideration leads us to the persistent problem of the status of the cooperative newsletters. Objections continue to be voiced against such citations because some feel that newsletters are not "official" or legitimate publications. I fail to see the distinction since the newsletters have a reasonably wide distribution, often including key national libraries, and reproduction of desired research notes can be provided without difficulty. In respect to the distribution of the cooperative newsletters, I would like to call attention to the unusually large foreign audiences that they reach. Recent enrollment figures for the TGC indicate that 51% reside in 40 foreign countries, a proportion of international representation that far exceeds that of scientific societies in the U.S.

Finances

Those cooperatives whose primary function is the annual meeting may have such insignificant organizational expenses that a treasury is not needed. On the other hand, funds must be

sought to finance the large newsletters issued by other cooperatives. Support comes from two main sources: membership subscription and philanthropic foundations or industries. Both systems of financing have their respective advantages and disadvantages. Benefactor support dispenses with the burdensome collection of dues and record keeping. On the other hand, the criteria for membership are more difficult to determine and observe in this system. As the membership increases it becomes more of a problem to distinguish between the individual with a *bona fide* interest in the cooperative and one who merely wishes to receive free copies of all reports. Subscription rates are nominal, currently ranging from \$.50 to \$2.00 per year.

Management

Much of the work involved in managing a cooperative is necessarily routine and is often sheer drudgery. Operations include: membership maintenance and list preparation; financial management in collecting dues, soliciting special contributions, payroll and accounting; meetings arrangements for time and place, plus notices and minutes; newsletter assembly, editing, proofing, publishing and distribution; exchange stocks maintenance and distribution; committee assignments and work; and correspondence for all purposes.

But, there are compensations – of a lighter sort – from the incredible amount of junk mail received. The names of cooperatives sooner or later appear on the mailing lists of all kinds of avidly soliciting businesses. They offer to facilitate conventions in Sun Valley, Idaho, the French Riviera, or other exotic watering places. Arrangements for charter flights to the meetings with exciting side trips can be included. Others offer flashy identification buttons and shirts emblazoned with the respective cooperative emblem. Finally, to spread the good word, TV film strips hosted by a "celebrity" can be prepared for the trivial amount of several thousand dollars for 50 frames (3-sec projection time).

Prospects and Conclusions

It is significant that the cooperatives have originated and flourished in the area of plant genetics and improvement. I believe that this relationship is not a coincidence; rather, it is based on the inherent nature of the materials and research subjects in this field. The existing cooperatives are admirably suited to integrate the inescapable complexities. Continually increasing stock lists must be maintained in order to contend reasonably with demands for

all kinds of germplasm. These include single gene stocks, multiple gene stocks for linkage screening, multiple gene stocks for detailed linkage study of single chromosomes, stocks with all manner of euploid, aneuploid, and structural changes, modern cultivars, primitive cultivars, geographic races of related species, and a wide array of breeding lines.

By maintaining lists of such stocks, often with references to seed sources and pertinent literature, the cooperatives perform an essential function for their membership and often for other workers. The factual information that expedites research in this area, furthermore, is of such a nature that it is difficult to conceive how it could be assimilated and presented effectively to the interested clientele except by cooperatives or similar media. I refer, for example, to the subject of linkage, in which every new fact may be a stepping stone on which further building of the maps is based. The sooner the facts are reported, the better the work of others can be facilitated. In these times, the established scientific journals could not possibly cope with the flow of these bits and pieces of information for each investigated species. Yet, with its resources, the cooperative can effectively present all of the submitted data and periodically summarize them in revised linkage maps.

As to the role of cooperatives in such other fields as disease control, growth regulators, nutrition, etc., I suspect that organization would more logically follow discipline rather than crop orientation. Since the basic methods and materials are so much more alike from species to species than they are in the area of genetics and improvement, crop-oriented cooperatives would scarcely be warranted for these disciplines. On the other hand, a genetics-improvement crop cooperative might conceivably expand into the fields that pertain to the husbandry of that crop – a trend already evident in the BIC and SFW.

The question might logically be raised concerning the effectiveness of the genetics-improvement cooperatives. From opinions that I have gleaned, I gain the impression that they are doing well. Colleagues returning from sessions of NCCBP, CIC, and TBRT are almost ecstatic with enthusiasm, claiming such meetings much more productive than national society sessions. Encouraging words are also heard regarding the annual newsletters, but one always wonders whether derogatory opinions are just not voiced.

Certain cooperative programs, for example, the organization of nomenclature systems and coordination of linkage studies, tend to be successful.

Officers and addresses (1970)

On the other hand, we have had to face failure as well. Five years ago the TGC sensed a need for synthesizing (isogenic) stocks of mutants with common genetic backgrounds. A committee of experts was selected from the membership which devoted much thought to the matter. It soon became apparent, however, that the selection of one, or even several generally acceptable genotypes, was a formidable obstacle. Performance over a wide variety of climatic conditions had to be considered, and it was exceedingly difficult to reduce the list of acceptable genotypes to a reasonable number. Even to the present time this issue has not been resolved.

Another problem that can be vexing is the indifferent attention sometimes paid to certain worthy programs. In the present informal status of the cooperatives, all of the scientific undertakings are conducted on a voluntary basis. By necessity these activities seldom rank high on the scale of the individual members' programs. Hence it is not surprising that they move erratically and sometimes cease moving altogether. A bit of verbal encouragement or pressure can help, and even more effective is an occasional diplomatic change of personnel. Lamentable as this situation might be, I would not care to sacrifice the freedom that the cooperatives now enjoy for the sake of gaining more consistent action in their programs.

In my opinion, the independence and diverse forms of the cooperatives have not hindered their functioning. They could stand to lose much and have little to gain by combination or other more formal organization. Our sciences are already topheavy with the framework of formal societies and the superstructure of coordinating groups. Independence has not led to excessive splintering of endeavor or organization; in fact I am not aware of any tendency on the part of the cooperatives to pre-empt any of the functions of the established scientific societies.

As to the future, I think we can reasonably expect to see more genetics-improvement cooperatives established for horticultural crops not yet represented. On the basis of recent experience, I could anticipate only continued growth in membership and expansion of activities in the existing cooperatives. A niche for coordinated research in genetics and improvement has been found in the ecology of horticulture, and the cooperatives are filling it effectively.

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