# MECHANIZATION OF FIELD PLOTS RESEARCH

By

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How does one really carry out a sunflower breeding program efficiently? My belief is that many of the operations, which we as plant breeders go through, can be mechanized. I may be talking only to about fifteen persons here in the room so perhaps the rest of you can bear with us. We might ask how can we handle large populations or a large number of plots without a maximum amount of technical assistance. A total mechanization concept is most important in becoming efficient along these lines.

We must analyze what it is that we are really doing. Many times I wonder if perhaps one of the best paid employees we could use on a short-term basis would be to have a systems analyst come to look at the physical processes we go through and suggest how we might improve. Some of the questions we ought to ask ourselves when trying to improve the efficiency of our program are: (1) "What information do we really want?" Many times we go out and collect data and more data until we get books full of data, but do we really use them. We ought to set a priority on that data we really want. Once we have done this, we may find that our efficiency may have been doubled. (2) "What physical processes must we go through to get the desired data?" Obviously to get the yield of a sunflower line one must plant and harvest the line and weigh the seed. This is a physical process. Within this physical process, what items can be standardized? It is very simple to say that we will plant a 10-foot row of this material and that we'll plant an 18-foot row of that material. We then proceed to change equipment, work different areas and waste all kinds of time just because we didn't standardize. Any time we can standardize a process, we likely become more efficient. Once we decide where we can standardize, then we must ask the next question (3) "Could a 'non-person entity' or a chemical organism or something else do this--something besides a person?" (4) "How much time does it take?" "Could another approach take less time?" "Is there an alternative?" And (5), "What are the actual desired or needed end products?" Sometimes we can go through this whole analysis and come up with a very beautiful scheme only to find out that it's more expensive than it would be to simply do a little more hand labor or make minor changes in the overall program.

Thus, I think that it is important in terms of mechanization of research plots to ask ourselves the basic questions, "What do we really go through?" "What do we really want?" and "How can we do it?" Sometimes we do things a certain way because that is the way it has always been done.

What are some of the things at Cargill that we have done which we feel have been useful to us? Those of you who see our farm tour, of course, will see this material. Here are some of the items that have been of use to us. For instance, it soon became obvious that if I packaged the breeding materials, which we send for NMR analysis, in the same envelope at the same seed quantity that I am going to plant - I wouldn't have to re-package. This wasn't a very big discovery, but I find very few people who do this. All the rows we plant are of the same row length and width. The plot numbering system is a descriptive geographic number. I have to thank Dr. Kinman for this system. He talked long and hard, and only after I had seen a few other people using the system was I finally convinced. Maybe I shouldn't say this but the old Minnesota system under which I had been tutored, simply was not an efficient system. By the system we use now, I find that I can arrange the packets in mechanical planting order in about one-tenth the time that it would take otherwise and that the precision is more than doubled. Such things are small items but tremendously useful. We found that there are other simple things like the seed boxes we use in packaging seed for planting. These are made of masonite and just fit the envelope. We are able to use the same boxes in putting up the seed, then with one re-arrangement we go from seed order to planting order (because of the number system we use). The same box then slips right into the planter and serves as a magazine from which we plant.

The key to efficiency in these operations has been our mechanical planter. Here are a couple of slides which will show you what I'm talking about. (slide) This is the tractor on our Research Farm. You'll see that we have marked off the nursery crosswise. The planter is mounted on a three point hitch, and has one wire to connect the electrical system of the planter unit. (slide) See the masonite boxes there that work as magazines to hold the seed packages. (slide) Two people ride the planter. With this planter we can plant over 1,000 rows per hour. (slide) A little closer look at the fellow in the planting operation. It doesn't take trained labor to perform this function. By using both hands, the limitation factor is how fast each hand can take a seed package and pour it in the planter unit. (slide) The planter units themselves are relatively simple. They hook onto a standard type planter unit. It is very easy to change from hopper planter to cone planter. (slide) You see the electrical solenoid here. This solenoid activates the lever mechanism at the top which allows the seed to be released and drop down over the cone. Not only does mechanical planting allow one to plant faster, but in this area it becomes very important because sometimes our season is rather short and we have to plant as rapidly as possible. Mechanical planting also allows us to cultivate with this tractor. Note the hours saved by not using a hoe. Additionally, we also use chemicals and a harrow to control weeds. Other little things have been useful like using a vacuum cleaner and milk filter disks to make

numerous crosses with male sterile plants in order to evaluate inbred lines. We collect pollen on the milk filter disk, put this along with a tag into a plastic bag and store it in a freezer until we pollinate. We then touch the milk filter disk to the flowers and we have a pollination made. This year, I am making over 3,000 of these pollinations. A number of you realize how different this process may be. Remember, I only have one technician.

Mechanization? In total I don't think it is as much machines as it is a concept. It's asking ourselves the question, "Can I really do it better if I analyze the entire process and do those things which are really important using as little hand labor as possible in the shortest possible time for the least cost to give the greatest improvement in our beloved sunflower crop?"

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DISCUSSION

Kinman: Are you counting seed or dipping into the package?

Johnson: We are dipping out of the package and overplanting.

Panchenko: Can we see that machine you use for planting?

Johnson: Yes, by all means. We will show it to you on the tour.

Leclercq: If there is a surplus of oil on the world market, why do we then keep breeding for more oil?

Answer: Those interested in oil consider the sunflower oil a very desirable oil for the food market. Additionally, the oil component is the most valuable part of the seed and it is natural to concentrate on the most valuable part in the breeding process.

Question: Should there be more effort on the protein aspect of the sunflower seed of breeding?

Kinman: Unfortunately, breeders have not proceeded along the lines of breeding for high oil and high protein at the same time. Breeding for higher oil seems to result in lower hull. Interestingly enough, as we have bred for higher oil, we have also realized higher protein content in the breeding materials. In the final analysis in breeding work there is a positive correlation between high oil analysis and higher protein analysis.

Rinke: How long are you able to store the sunflower pollen in the deep-freeze?

Johnson: I have pollen used in the plots that was stored two years ago. I will know in about two months whether this has been successful.

Question: Have you tried it with other species?

Johnson: I have not tried it.

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