Paper 12

OFF SEASON NURSERIES IN NEW ZEALAND FOR NORTHERN HEMISPHERE MAIZE BREEDERS

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INTRODUCTION

The concept of introduction, exchange and exploitation of genetic material, for the purpose of improving plants for use by man, is not a new one — both the pre and post-Columbian eras played a vital role in developing the basic concept of plant breeding, which to this day has not changed. What has changed, in the twentieth century, is that the seed industry has become highly competitive and this has consequently led to the use of sophisticated, objectively oriented and regulated procedures in plant breeding. One aspect of this increased competition is that plant breeders are using various means of "speeding-up" the breeding programmes. Advancement of breeding material by an additional generation can be achieved through the use of seasonal differences between the northern and southern hemispheres; it is in this context that off season nurseries are grown in New Zealand.

Crop Research Division of DSIR has, over the years, been successfully operating off season nurseries for small grain cereals in cooperation with northern hemisphere plant breeding institutions. Involvement with maize began in 1976-77 season, on a trial basis, with the Plant Breeding Institute, Cambridge, U.K.; the Swiss Federal Research Station for Agronomy, Zurich, Switzerland; and I.N.R.A., Clermont-Ferrand, France, as the cooperating institutes. Since these preliminary trials there has been an expansion in the size of the nurseries, but Crop Research Division is now involved only with the University of Guelph, Canada.

Prior to 1976, there was only minor involvement by the private sector in such schemes. This has now changed and the New Zealand seed companies, namely Corson Seeds International Ltd., Wrightson NMA Ltd. and Malabar Partnership have set up large scale operations for handling off season nurseries for companies from France, Germany, Holland and Canada.

SEED PRODUCTION OBJECTIVES

Seed may be sent to New Zealand for:

- The development of new populations to serve as base material for the development of new inbred lines.
- The production of top-cross seed of partial inbred lines for evaluation of their yield potential in the following northern hemisphere season.
- The advancement of promising genetic material by an additional generation of selfing or backcrossing.
- The production of hybrid seed of advanced inbred lines for the assessment of the commercial potential of the hybrid in the following northern hemisphere season.

QUARANTINE REQUIREMENTS

In contrast to other major maize growing areas of the world, New Zealand is relatively free of some of the serious maize diseases and insect pests. In order to protect the industry, plant quarantine regulations are rigorously enforced and in all cases an import permit is required. Incoming maize or sweetcorn seed must be accompanied by an international phytosanitary certificate endorsed to the effect that the seed was harvested from a crop that was free of bacterial wilt (*Erwinia stewartii*), Goss's wilt (*Corynebacterium nebraskense*), downy mildew (*Sclerospora sorghi*), boil smut (*Ustilago maydis*) and maize dwarf mosaic virus (MDMV). The certificate must be signed by a plant pathologist, either from a university or from a relevant government department. Prior to planting, the seed must be treated with a mixture of carboxin and thiram and the site must be approved by field officers of the Ministry of Agriculture and Fisheries. The nurseries must be isolated from other maize and sweetcorn crops by a minimum distance of 500 m for material originating from Europe and Canada and 2000 m for material from U.S.A. They are subject to periodic inspection by field officers throughout the growing season and the material can be destroyed if any one of the above mentioned diseases or specified insect-pests eg. corn borer or root worm, becomes apparent.

Some overseas institutes also impose quarantine regulations for seed from New Zealand. For example, the University of Guelph stipulates that its nursery stock be

grown in soil free of potato wart disease (*Synchytrium endobioticum*), potato cyst nematodes (*Globodera rostochiensis* and *G. pallida*), and soybean cyst nematode (*Heterodera glycinea*). In addition, an endorsement may be required to the effect that the seed was harvested from a crop that was free from head smut (*Sphacelotheca reiliana*).

Prior to re-export, the field officer makes a random check of the seed for soil particles and insect-pests before issuing a certificate to accompany the consignment.

FIELD PROCEDURES

Isolation blocks are used for producing hybrids or for making top crosses where a large number of partial inbred lines are used with only one pollen parent. Seed parents (female lines) are detasseled by hand in contrast to mechanical detasseling practised by commercial seed producers. The planting pattern in isolation blocks also differs from that practised in commercial seed production. The ratio of male to female rows in the blocks varies subject to the requirements of the breeder concerned. The material in the blocks is generally hand planted, however, Corson Seeds International Ltd., have mechanized large scale operations through the use of sophisticated machines.

Controlled pollinations are necessary when more than one male parent is present in the nursery. Every breeder has his own technique of doing hand pollinations but the end result is the same. The covering of the female flowers (silks) is critical, and if not done at the correct time it may lead to pollination by foreign pollen. The ears, therefore, are covered with parchment paper or plastic bags prior to silk emergence. The male flowers (tassels) are covered with paper bags the day before pollination — the time period of 24 to 30 hours ensures the "killing" of all foreign pollen grains on the tassel. The pollinated ears are covered by brown bags which are left there for the next six to seven weeks. At the end of this period the embryo is fully developed and physiologically mature; the grains are in their early dent stage and it is at this point that harvesting commences.

Prior to commencement of pollination, rougueing is an important aspect of the operation. Rougues are the out-crosses which must be destroyed, before pollen shed, to prevent contamination of seed lines.

Harvesting commences with the picking and husking of the ears in the field. Husked ears are placed in net bags and air-dried at 30-35 °C, so as not to injure the embryo. After drying, the ears are shelled. Diseased or discoloured grains and other extraneous material is discarded before packaging. The consignments of seed are air-freighted back to the respective institutes in the northern hemisphere to arrive there in time for spring planting. The cycle is repeated again when material is sent to New Zealand in October/November, thus giving the breeders two generations in one year.

SCALE OF OPERATION

During the 1984-85 season, seed companies in New Zealand had a total area of 14 ha. in off season nurseries, including the area under eleven isolation blocks. Most of these nurseries were located in the Gisborne district, and over 100,000 hand pollinations were made. Crop Research Division, at Pukekohe, had approximately one hectare of land, including the area under three isolation blocks, and over 10,000 hand pollinations were made in this nursery.

CONCLUSION

In conclusion we would like to consider the advantages and disadvantages of operating these nurseries in New Zealand.

To the local seed companies, the operation of off season nurseries provides income in overseas currencies. In addition, it provides contacts with plant breeders, seed technologists and company managers from overseas who often provide information of value to the New Zealand maize industry. Because the operations of these nurseries are labour intensive, they provide employment for New Zealanders, especially students, over the summer period.

The only disadvantage these nurseries pose is the threat of introducing new pests and diseases into New Zealand. This subject, though not specifically directed towards maize, has been reviewed to some extent by Palmer (1980, 1981) and Smith (1981, 1983). Stringent inspection of incoming maize lines by quarantine officials should preclude the entry of unwanted pests and diseases.

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