9. Lunt, O.R. and B. Clark. 1959. Horticultural applications for bark and wood fragments. *Forest Prod. J.* 9: 39A-42A.

MODERATOR ROLLER: Thank you, Glen. Our next speaker is Dr. Roger Uhlinger who will tell us about some of the new garden carnations.

DEVELOPING GARDEN CARNATIONS

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The carnation breeding program at the University of Nebraska, North Platte Station, is entering its 5th year. Our long term goal is to develop garden carnations with the following characteristics:

1. Sufficient hardiness to survive and perform well in the environment of the Great Plains.
2. Florist quality blooms.
3. "Open" inflorescence that will not require disbudding.
4. Erect stems that will not require support.
5. Sufficient field resistance to soil-borne pathogens to remain attractive throughout the growing season.
6. Everblooming habit of flowering.
7. Frost tolerant buds.
8. Evergreen foliage.

This ideal will not be reached quickly. However, these characteristics are all present in the breeding complex we are using and I believe we can eventually get them all together.

The material that forms the basis for our breeding and development program originated from three sources. The first is advanced generation offspring from crosses between the Grass Pink (*Dianthus plumarius*) and Chabaud carnations which were made by Glenn Viehmeyer 10 or 15 years ago. This material is perfectly hardy under our environmental conditions. The flowers are small, single or semidouble, moderately fragrant, and quite fertile. The plants tend to be of open habit and have fine-textured foliage. Flowering stems are slender with buds well spaced in the inflorescence. Stem attachment at the crown is weak so the plants either develop in a decumbent mode or they are easily broken down by wind and rain.

The second source of germplasm is material from the U.S.D.A. Carnation Breeding program at the Cheyenne Horticultural Field

Station. Mr. Gene Howard has been working to develop polyploid carnations for use in greenhouse production. He has collected polyploid sports from commercial varieties of *Dianthus caryophyllus* and has induced polyploidy by colchicine treatment of apical meristems. Howard has utilized "Little Joe' and 'War Bonnet' plus 3 or 4 hardy species of *Dianthus* as parents. Interspecific hydridization has been followed by colchicine treatment to produce allopolyploids which could then be bred with polyploid *D. caryophyllus*. The Cheyenne material provides us with large blooms, high petal count, and stiff stems. Foliage of these polyploids tends to be thick and relatively coarse. Primary breaks are usually erect but secondary flowering stems (which provide re-blooming) tend to be decumbent.

Germplasm of 'Aqua' is the third source of genetic variability for our program. This "ground cover" type carnation is extremely hardy as well as being evergreen. Unfortunately, 'Aqua' blooms massively once each year with very little re-blooming. Calyx splitting is another undesirable characteristic that is present in this germplasm. 'Aqua' is female sterile and only about one flower in 20 produces a functional anther. After many attempts, a successful cross to a *Dianthus plumarius* hybrid was made. The F_1 exhibited the good and the bad characteristics of 'Aqua' but it is both male and female fertile so we can begin to use this material in our breeding complex.

Our program has developed as follows:

1969 to 1971 — Field screening of auto and allopolyploid carnations from the Cheyenne program. Approximately 1500 plants were grown in the field without any winter protection. Several of these survived 2 winters and a few have survived 4 winters.

1971 to the present — Advanced generation offspring of the *D. plumarius* x Chabaud carnation crosses have proved to be compatible with the polyploid greenhouse carnations. Controlled crosses between the *D. plumarius* hybrids and the "hardy" polyploid carnations were initiated in the winter of 1970/71. The "hardy" polyploids were also intercrossed and outcrossed to 'War Bonnet'.

F_1 hybrids were grown in the field in 1971 and some preliminary selecting was done. Open pollinated seed has been harvested from selected plants in order to generate advanced generation populations for field evaluation. We have not had much success with controlled crossing in the field so backcrosses of selections to carnation and intercrosses among selections have been made in the greenhouse during each succeeding winter.

We try to have at least 10,000 seedlings in the field for preliminary evaluation each year and about 1% of these are selected for further trial. A few cuttings are rooted from each selection and

are planted out in the second year if the original plant survives the winter.

We have not done much in the way of field culture experimentation but we have observed that performance of cuttings rooted on or before March 1 is superior to that of cuttings from later propagations. Removal of spent blooms improves the appearance of the plants but has a varying influence on number of flowers produced depending on the clone involved.

Soil-borne pathogens are most troublesome in field-grown carnations. We do not have a good handle on genetic resistance and chemical control leaves something to be desired. Our plots are thoroughly contaminated with *Fusarium*, *Rhizoctonia*, *Alternaria* and *Botrytis* so if genetic resistance is present in our breeding complex it will have ample opportunity for expression. I think we do have some resistance to these pathogens but at present we do not have it fixed.

We record data on erectness, height, buds per stem, type of inflorescence, flower size, number of petals, flower quality, foliar color and foliar density. On the basis of yearly averages for these characteristics, we are: 1) having difficulty in obtaining erect plants with open inflorescences; 2) doing quite well in selecting for increased petal count and decreased number of blooms per stem; 3) making slow progress in improving flower size on the hardiest selections; and, 4) making very slow progress in combining all the desirable characteristics.

MODERATOR ROLLER: Thank you, Dr. Uhlinger. The next paper on this portion of the program is entitled "Overwintering Container Conifers in Prairie Canada", and will be presented by Mr. Lawrence Aubin.