GEORGESON BOTANICAL GARDEN

University of Alaska Fairbanks
Agricultural and Forestry Experiment Station

Georgeson Botanical Notes No. 12 Rev. June, 1993

The Challenge of Cultivating Plants in Cold Soils

by

Dr. Patricia S. Holloway

Gardening in Cold Soils

One of the biggest challenges to plant cultivation in Alaska is cold soils. During our short (approx. 105 day) growing season, soil temperatures average about 55°F at a 4-inch depth. These cold soil temperatures reduce root growth, limit uptake of plant nutrients, and reduce yield of warm season crops such as tomatoes, cucumbers, peppers, and winter squash. At the turn of the century the most common field vegetable crops grown in Interior Alaska included potatoes and cool season crops such as cabbage, broccoli, cauliflower and turnips. Only pioneers lucky enough to have a greenhouse or who homesteaded near hot springs could grow tomatoes and cucumbers.

The problem of cold soils was recognized early by residents of the Far North and the researchers at the Agricultural Experiment Station. Newspaper articles, research publications, and farming "How to" guides were full of information on methods of soil warming and season extension. Hotbeds fueled by manure, cold frames, portable shelters, raised beds, terraces, and planting on south-facing slopes or beds were common recommendations for home gardens. In the 1940s researchers recommended spreading coal dust to melt snow and extend the season. Additional coal dust was then spread on the prepared soil to blacken it and help increase soil temperature.

Agricultural Experiment Station agronomist, Dr. Basil Bensin was the first researcher to explore methods of soil warming specifically for warm season crops. In the 1940s he advocated the use of solar radiator-reflectors to promote growth of tomatoes. Black colored solar radiators could be used to increase soil and air temperatures around plants. Reflectors were made of metal, plastic, corrugated aluminum, or wood covered with aluminum paint and placed vertically on the north side of the plants. Light levels could be increased 3–5 times with aluminum reflectors, and the increased radiation improved soil temperature. With the addition of coal dust on the soil surface, crops such as cucumbers, pumpkins or squash could be grown successfully in home gardens.

Beginning in the 1960s Professor Emeritus Dr. Donald H. Dinkel experimented with the use of different mulching products to warm soils. Products such as clear polyethylene, black polyethylene, black petroleum mulches and black paper were tested extensively on a diversity of vegetable crops to determine which, if any, would warm soils sufficiently to promote growth. Soil temperatures as high as 120°F at a 4-inch depth were possible beneath a clear polyethylene mulch. For the first time, not only could some warm season crops be grown in field soils, but yields were such that commercial production was now possible. Since Dr. Dinkel's early experimentation with polyethylene mulches, techniques have been refined for a variety of crops through research at the Agricultural and Forestry Experiment Station. Clear polyethylene mulch is routinely used in both home and commercial fields for the production of tomatoes, peppers, cucumbers, squash, and pumpkins.

One significant problem with the use of clear mulches is extensive weed growth beneath the plastic. Until recently, herbicides were the only solution to the weed problem. In the late 1980s, a wavelength selective mulch called infrared transmitting (IRT) polyethylene film was developed at the University of New Hampshire. This product was designed to warm soils and suppress weed growth by a dual effect of lower light intensities and higher temperatures beneath the mulch. In limited tests with sweet corn at the Georgeson Botanical Garden, yield of plants growing on IRT film was similar to plants growing on clear polyethylene mulch plus herbicide, and no weeds grew beneath the IRT mulch. Growers around the Tanana Valley have had mixed results with IRT mulches. This new generation of mulches holds promise for growers interested in herbicide-free production.

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