GROWING SWEETCORN
in Alaska's cool environments

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Goldmine sweet corn grown on a mulched plot at Matanuska, Alaska, was ready for harvest in late August of 1964.

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SUMMARY

Sweet corn can be grown in Alaska's cool environments by employing clear polyethylene mulch to raise soil temperatures.

Rows should be run north and south, spaced about 5 feet apart for 4-foot wide mulch.

Weeds can be controlled under clear polyethylene mulch by spraying with atrazine after seeding and before mulching.

ADVANTAGES OF CLEAR MULCH

- Higher soil temperatures.
- Faster and better germination.
- Moisture conservation through reducing evaporation.
- Extension of the growing season at the seedling end of the growth cycle. Spring frosts are not as critical where plants are covered with polyethylene mulch.
- Accelerated growth and early maturation.

GROWING SWEET CORN IN ALASKA

FEW gardeners in Alaska have succeeded in growing sweet corn, although many have tried. Cool soil and air temperatures, rather than an insufficient frost-free period, have been suggested as the reason warm season crops such as corn are not adapted to this environment. Low soil temperature is probably the most critical factor limiting the growth of sweet corn in most areas of Alaska.

A minimum soil temperature of 50°F has been generally accepted for germination and growth of corn. Average temperature at a two-inch soil depth is seldom much above 50°F in Alaska's Matanuska Valley. Comparisons of clear, black and smoke polyethylene mulch, black petroleum mulch, black paper and combinations of some of these materials showed that only clear polyethylene raises soil temperatures sufficiently to produce sweet corn consistently in south central Alaska. During the past decade several cold tolerant sweet corn varieties have been developed. The availability of these improved varieties has contributed to the successful production of sweet corn in Alaska.

CLEAR POLYETHYLENE MULCH

Clear mulch has several incidental advantages. It fosters faster and more complete germination of corn seed which emerges in time to take advantage of the long days during the solstice. The young seedlings under plastic are protected from light spring frosts, so that earlier planting is possible. By conserving moisture in the surface soil, roots are enabled to grow nearer the surface, taking advantage of a warmer environment.

Short-wave solar radiation is readily transmitted by clear polyethylene to the soil underneath thus raising its temperature. The warm soil radiates at a longer wave length which clear polyethylene does not transmit as readily. Moisture vapor often present on the polyethylene also absorbs long-wave length energy radiated from the soil. Clear polyethylene thus retards heat loss from the soil. The trapped heat is not dissipated by wind nor by the evaporation of soil moisture, which is greatly reduced by clear polyethylene mulch.

Greatest rises in soil temperature under clear polyethylene occur during sunny periods. Figure 1 shows the effect of solar radiation on soil temperature at the two-inch depth under clear polyethylene as com-

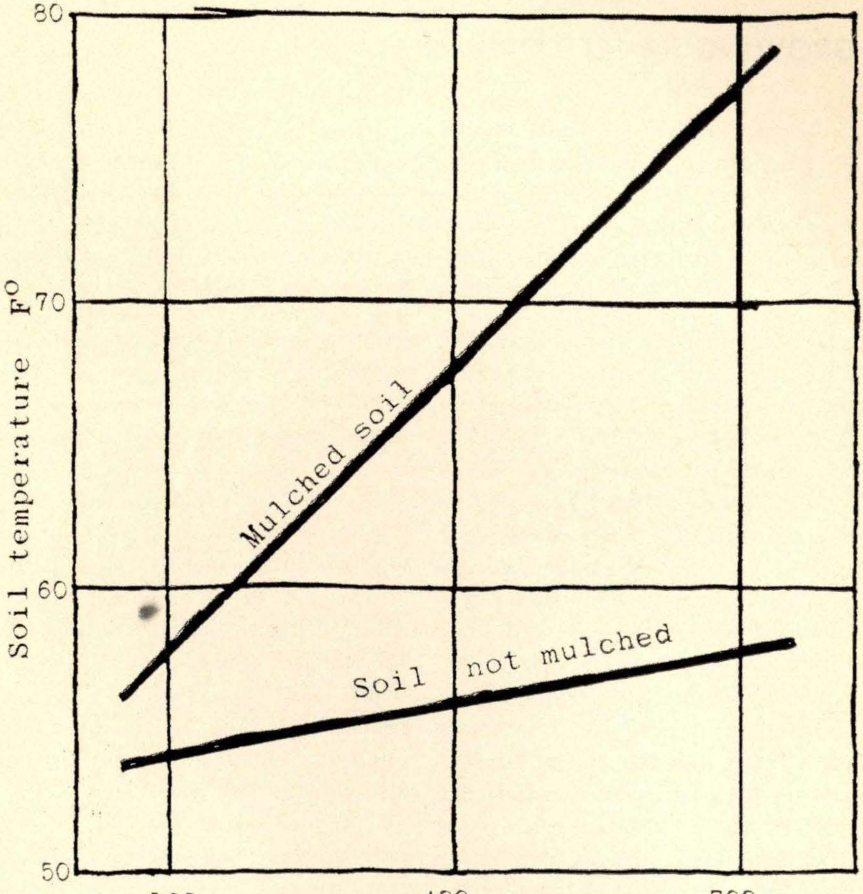

Figure 1.—Relation between total daily incident radiation (Langleys, measured by an Epply pyranometer) and soil temperature of mulched and unmulched plots (average of daily minimum and maximum two inches below the surface) for 24 days in June 1964. Left extreme represents cloudy days, right extreme sunny days.

pared to uncovered adjacent plots during June 1964. Lines show the relationship between daily averages of the maximum and minimum temperatures and the amount of incident radiation accumulated during that day. Accumulated daily radiation (Langelys per day) for the month of June 1964 varied from a low of 122 on a dull, cloudy day to 758 for a clear, sunny day. Little difference existed between the soil temperature in covered and uncovered plots on dull, cloudy days, whereas great differences developed during clear, sunny days. On sunny days soil temperature differences of 30°F or greater were found under clear mulch as compared to unmulched plots. Soil temperatures under black polyethylene mulch resemble those found in unmulched soil.

In studies at Matanuska during 1962 and 1965, marketable ears were obtained when sweet corn was grown through clear polyethylene but not when grown through black polyethylene or without polyethylene covers. Table 1 presents details on date of planting, date of first harvest and yield per foot of row for two varieties grown through 4-foot wide clear polyethylene. No corn was produced in any year by any varieties not mulched with clear polyethylene. Under clear polyethylene mulch, 4 to 10 times more seed germinated than in unmulched plots. Plants mulched with clear polyethylene grew as much as three times the height of unmulched corn.

Table 2. — Response of Earliking sweet corn, in terms of average height attained, to width of clear plastic mulch, Matanuska, Alaska, 1965.

Mulch width	Height attained by - July 20	Aug 10
	Inches	
None	10	21
3 feet	27	41
4 feet	34	53
5 feet	29	46

The common thickness of polyethylene film for mulch is 0.0015 inches (1.5 mil). Data collected during 1965 on the effect of width of mulch is presented in Table 2. Maximum height was obtained with 4-foot wide clear polyethylene, which was a better response than obtained with a 3-foot strip. A strip 5-feet wide was no better than the 4-foot width. The same sort of a response to 3- and 4-foot polyethylene was found in 20 other varieties tested in 1965.

To insure best success and earliest harvest sweet corn should be planted on the earliest ground as soon as it can be properly prepared and worked in the spring. Good sites are gentle south-fac-

Table 1.—Planting date, first harvest date, and yield of marketable ears per foot of row for two adapted sweet corn varieties, Matanuska, Alaska, 1962 through 1965.

Variety	Planted	First harvest	Ears per foot
Goldmine . . .	June 6, 1962	Sept 6	—
Goldmine . . .	May 10, 1963	Aug 26	1.3
Goldmine . . .	May 12, 1964	Aug 25	1.5
VH-631	Mav 14, 1965	Aug 30	0.9

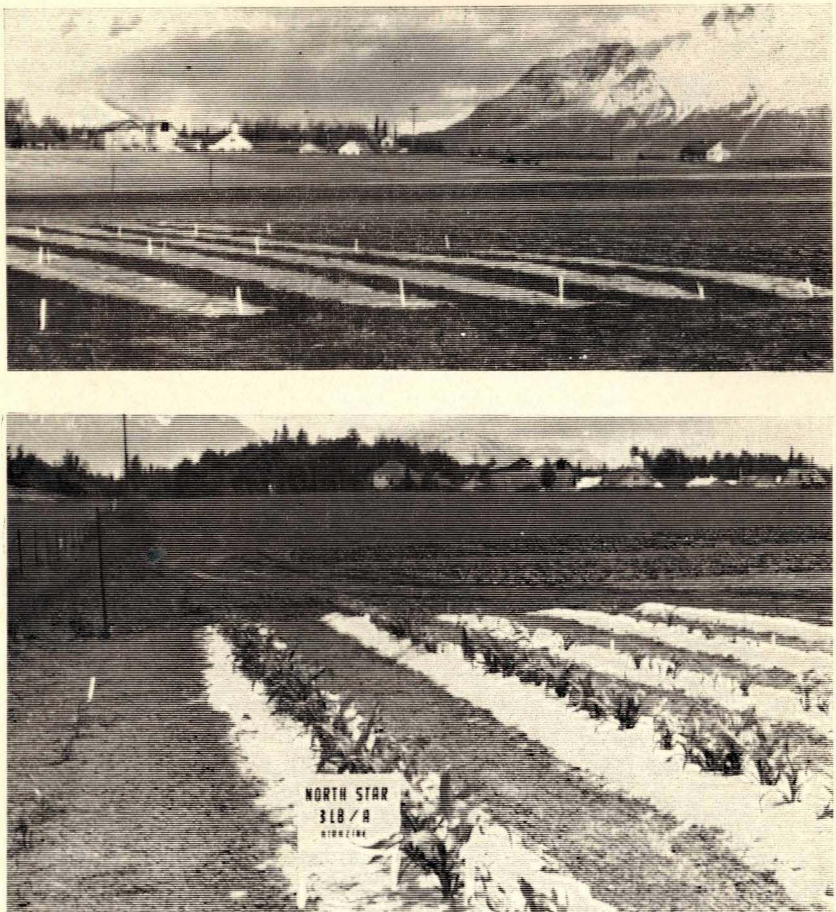

Figure 2.—Above, sweetcorn plots at Matanuska in 1964 after planting and mulching. Below, same plots several weeks later. Note poor stand and growth of unmulched plot at far left.

ing slopes away from trees and buildings that might shade the planting.

The necessary fertilizer should be applied (2 1/2 pounds/100 square feet of 8-32-16 or its equivalent), worked into the soil, and the surface prepared into a flat, fine seedbed. A flat seedbed without clods makes it easier to apply film mulch. Polyethylene covers retard evaporation of soil moisture so the seedbed can be left in a fluffy condition without fostering excess moisture loss.

It is recommended that corn be seeded about 1 1/2 inches deep in one- to two-seed hills, one foot apart in the rows. Rows should run north and south. They should be spaced far enough apart so they can be conveniently covered without interfering with the polyethylene covering of adjacent rows. Five to 6-foot wide row spacings are needed for 4-foot width polyethylene. Figure 2 shows a planting of sweet corn just after the mulch was applied by hand, together with the same planting several weeks after the corn had been let out from the polyethylene.

APPLYING POLYETHYLENE MULCH

Polyethylene mulch can be applied by hand (or with mulch laying machines on large areas). Plastic mulch must be securely anchored around all edges with soil so that it is not blown off. Where winds are prevalent during the spring, as in the Matanuska Valley, special care is needed. Dig a trench 4 to 6 inches deep parallel to the seeded row so that when the polyethylene sheet is centered over the row about 6 inches will overlap into the trench. Roll out the polyethylene and anchor one side first by filling the trench. Repeat the operation on the other side, stretching the polyethylene tight across the row. Ends should also be trenched in and covered. Mulch laying machines are towed by a tractor. They dig trenches on both sides of a seeded row, roll the plastic out, and press its edges into the trench. Shovels or disks then cover the edges.

When the seedlings are 3 to 4 inches high, slit the polyethylene directly over them and gently pull the leaves up through the slit. The plants will not by themselves emerge through holes in clear polyethylene.

WEED CONTROL

Weed growth under a clear polyethylene cover may seem to present a problem. If the edges of the polyethylene mulch are securely anchored it has not been necessary to eliminate the weeds. Weeds under the mulch have not produced viable seed to reinfest the soil. Not much plant food and water is actually lost to weed growth confined under the polyethylene.

Annual weeds can be controlled by spraying the seeded row with atrazine herbicide at the rate of 1 teaspoon (75 per cent atrazine) per gallon of water (3/4 pound of active ingredient per acre). A gallon should cover 500 square feet. The spray is applied before the mulch.

This rate has given excellent season-long weed control under mulch, with no harm to the corn. It is not sufficient to control weeds in unmulched soil. Warm moist conditions under the mulch create a better condition for weed control. Weeds can be controlled on the exposed soil between rows and around the edges of the polyethylene by spraying with Premerge (DNBP) at the rate of 5 pounds per acre. Spray before pulling the corn through the mulch but after weeds have germinated.

Atrazine applied at higher rates remains in the soil so this herbicide should not be used if it is intended to grow some crop other than corn on the treated plot in the following year.

POLLINATION

Adequate pollination is needed for good, well-filled ears. Best natural pollination is achieved when corn is planted in several short rows rather than one long row. If corn is planted in one long row, then pollen from tassels should frequently be shaken over the developing silks.

VARIETIES

The earliest varieties available are suggested for Alaska. Goldmine sweet corn has, under mulch, consistently produced ears comparable to those obtained in southern environments. Other good varieties of which seed is now available are Earliking, Spancross, Sunglow and Golden G101. The earliest varieties in these tests were two seedlings, one from an Alaskan breeding program, the other (VH-631) from a breeding program conducted at Vineland, Ontario. Seed of these new varieties should be available in a few years. At Matanuska no sweet corn varieties produced ears unless grown under clear polyethylene mulch.

Black polyethylene excludes visible light and for this reason restricts weed growth under it. Exclusion of visible light also makes it possible to mechanize this mulch since machines are now available which burn a hole in the plastic and plant a seed through it. Light passing through the hole phototropically guides the growing seedling through it, thus eliminating the hand labor of releasing the plant from the mulch. Black polyethylene, however, does not transmit heat rays to the soil and so is undesirable for corn production in Alaska.

On the other hand, clear polyethylene transmits and traps solar heat but does not suppress weed growth. Both black and clear polyethylene retard moisture loss.

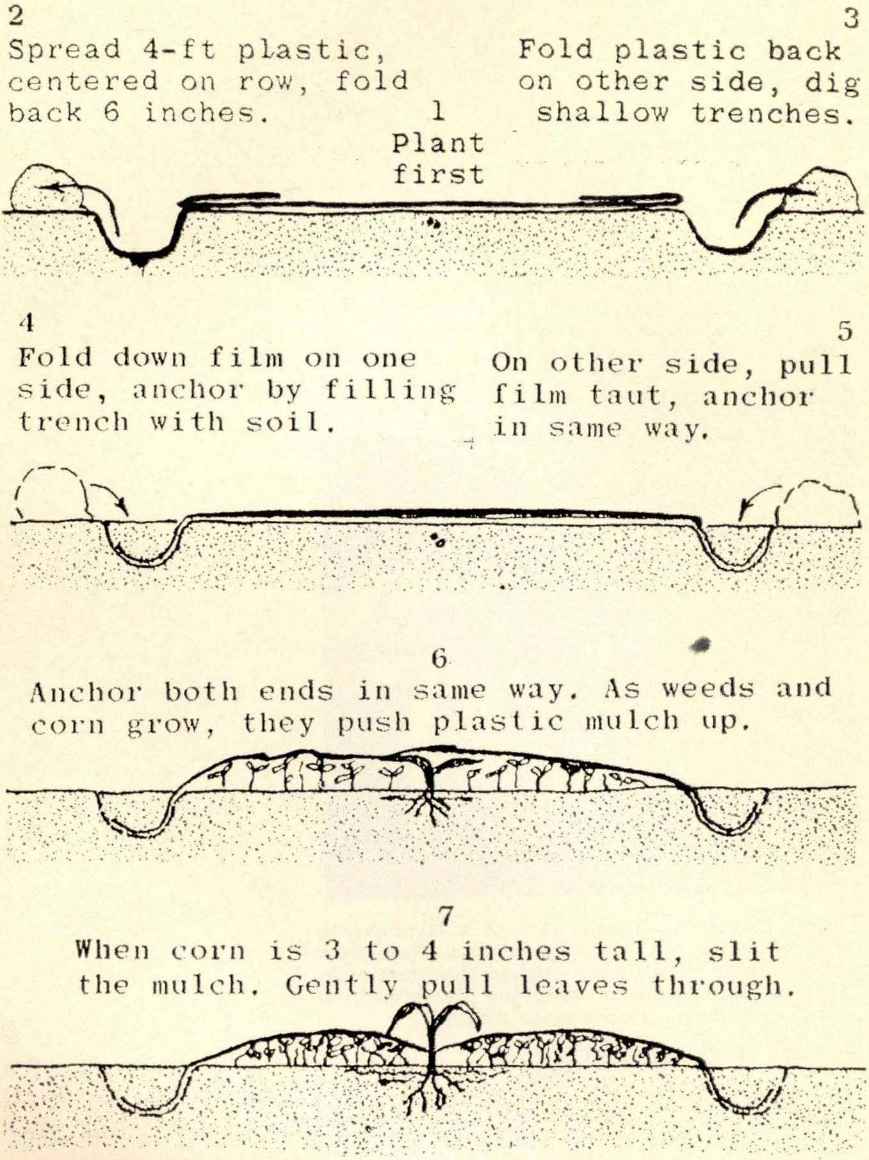

Figure 4.—Steps in planting and mulching corn.

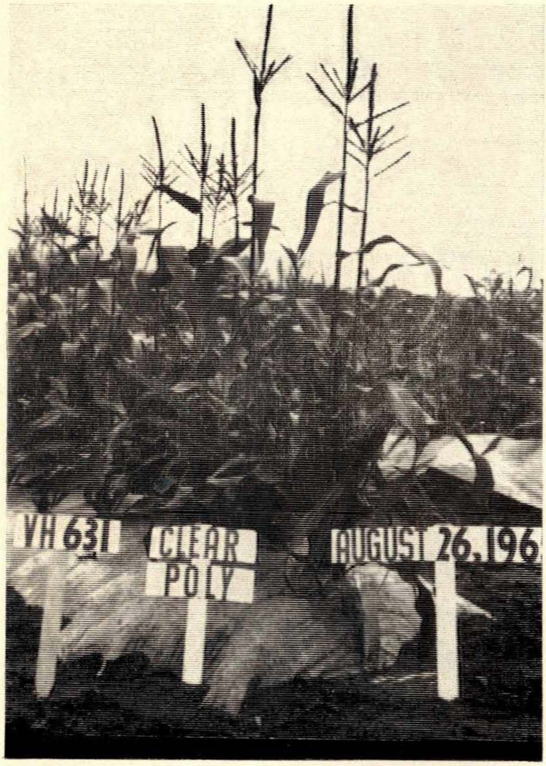

Figure 3.—Mulched corn plot at Matanuska in 1965, a cooler than average season. Note how weeds under mulch have pushed the plastic up. Vigorous weed growth under the plastic did not reduce the corn's response to mulch.

FUTURE DEVELOPMENTS

A polyethylene cover that would transmit radiation in the infra-red region of the spectrum while excluding visible light would combine the advantages of both clear and black plastic. It would trap heat, conserve moisture, control weeds, and guide seedlings through pre-cut holes thus allowing mechanization. Such a material may be available in a few years.