Wavelength-selective mulches and tomato production in Fairbanks, Alaska

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The selective reflecting mulch, SRM-Red™, has been shown to increase yield of first quality early market tomatoes when compared to tomatoes grown through black plastic mulch (Fortnum and others 1997, Csizinszky and others 1995, Heacox 1995). SRM-Red™ increases yield by reflecting far-red wavelengths of light into the plant canopy which promotes shoot growth, and flower and fruit development (Kasperbauer and Hunt 1998). This product has engendered interest in Alaska where field cultivation of high quality tomatoes is difficult, and yields may be quite low.

In the Interior, many people grow tomatoes through clear plastic or infra-red transparent (such as IRT-100™) mulch in order to warm cold soils. Clear mulches are the most effective at warming the soil, but IRT mulches eliminate weed growth beneath the mulch by blocking the radiation used for photosynthesis. During most seasons, yield of temperature-sensitive crops such as sweet corn are comparable when grown through clear or infra-red transparent (IRT) mulches (Matheke and others 1991). The purpose of this project was to evaluate the effects of SRM-Red™ on yield of field-grown tomatoes in Fairbanks, Alaska and to compare yield with the standard IRT-100™ mulch.

Methods

'Sub Arctic 25' tomatoes were seeded in the greenhouse during the third week of April and transplanted into the field at 30–inch (76cm) spacing in rows five feet (1.5m) apart on June 3.. Plots were fertilized with 3 lb per 100 ft² (1307 lb/A) 10–20–20s (s = sulfate of potash) and tilled prior to transplanting. Rows were oriented in an east/west direction. Roberts Ro-drip trickle irrigation tape was laid adjacent to the planting row, then the row was covered with a three-foot (91 cm) width of either SRM-Red™ and IRT-100™ mulch. Plots were arranged in a randomized complete block design with four replicates and three plants per replicate. Tomatoes were harvested at the pink to red ripe stage. Weather data were compiled from a U.S. Weather Service station, elevation 475 ft (145 m), located approximately 350 ft (107 m) west of the garden. The experiment was repeated for two seasons, 1998 and 1999.

Results

There was no significant difference ($P<0.05$) in the average yield per plant, individual fruit weight or the number of fruit per plant between SRM-Red™ and IRT-100™ mulch in both years of the study (Table 1). There was a significant difference in the yield between 1998 and 1999.

Table 1. Yield and fruit weight of tomatoes grown through IRT-100™ and SRM-Red™ polyethylene mulches in 1998 and 1999.

Year and Treatment.	Number of fruit per plant	Fruit yield per plant (kg)	Individual fruit weight (g)
1998*			
IRT-100	11.6 + 5.4	0.4 + 0.2	40.8 + 5.2
SRM-Red	12.2 + 1.8	0.4 + 0.1	36.3 + 6.3
1999			
IRT-100	105.8 + 0.2	3.6 + 0.4	34.3 + 1.2
SRM-Red	101.7 + 0.1	3.4 + 0.4	33.4 + 3.1

*Data within columns and between treatments in each year do not differ significantly at P=.05; data between years differ significantly for yield and number of fruit per plant, P=.05.

In 1998, the weather was unseasonably cool and wet after a warmer than average May (Table 2). In 1999, the weather was appreciably warmer than 1998 with above average temperatures from June through September. Although the frost free period was similar each year, much of the frost free period in 1998 was early in the season before the tomatoes had been set out. In 1999, more of the frost free period extended into the fall resulting in an extra 14 days of harvest.

Conclusions

The difference in tomato yields between 1998 and 1999 is striking. In 1998, we harvested an average 0.93 lb (0.4 kg) per plant, whereas in 1999 yield was nearly 8 lb (3.6 kg) per plant. The large difference in yield between 1998 and 1999 can be

Table 2. Weather records for 1998 and 1999 growing season.

	May	June	July	August	September
Average daily max. F					
1998	62	68	73	61	61
1999	58	73	72	69	56
30 year 49–94	60	71	73	66	54
Monthly high temp					
1998	80	85	87	80	67
1999	70	91	85	87	68
Average daily min. F					
1998	36	48	51	44	39
1999	34	49	50	46	34
30 year 49–94	38	49	52	47	35
Monthly low temp					
1998	28	38	44	31	2
1999	28	35	41	33	16
Rainfall (inches)					
1998	0.63	1.30	3.38	2.68	1.40
1999	0.32	2.12	2.06	1.89	2.27

	1998	1999
Last Spring frost	18 May	29 May
First Fall Frost	28 Aug	11 Sept
Frost Free days	102	105
Thaw degree days	2626*	3383**

*Until 1st fall frost, 28 Aug 1998
**Until 1st fall frost, 11 Sept 1999

attributed to cooler and wetter weather in 1998 and the longer harvest period in 1999. Even under the vastly different growing conditions of these two seasons, there was no difference in the yield (in numbers of fruit or weight), or in the average weight of the fruit between the two mulch treatments. In both warm and cool seasons, the mulches produced the same results. Although we did not measure soil temperatures beneath the mulches, tomatoes grew as well on the red mulch as the IRT mulch treatments indicating that it did not cool soils sufficiently to cause yield reductions. For tomatoes as well as other warm season crops, we continue to recommend the use of clear polyethylene mulch for maximum soil warming to promote both earliness and higher yields. But either SRM-Red™ or IRT-100™ mulches are a good alternative where weed control beneath the mulches is necessary.

References

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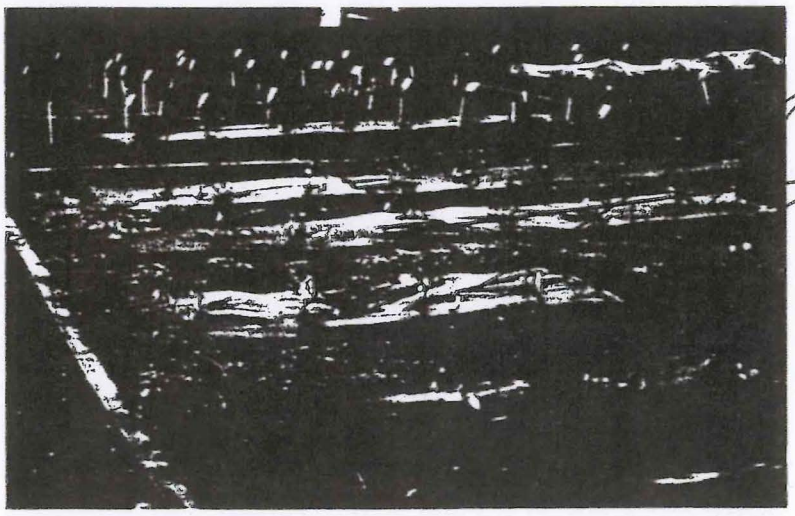

Plots were established using SRM-Red™ and IRT-100™ mulch with grass clippings in walkways. GBG file photo