White Paint for Farm Buildings

characteristics of white paint prevent excessive heating of metal farm structures by radiation from sun, sky, environs

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Part of a galvanized steel storage building in the Imperial Valley was painted during the summer of 1955—to study the influence of white paint on the thermal environment within a steel building and under metal animal shades—as part of a research project concerning the modification of the environment to improve animal gains.

The long dimension of the storage building was oriented north and south. The exterior of the south end—and the south 20′ section—were painted with standard white house paint. The center 20′ section was painted with bone-white paint. The north section and north wall were left unpainted.

Temperatures of the different sections were measured with thermocouples attached to the inside surfaces. The temperatures of the painted surfaces were greatly reduced. At 1:00 p.m., when outdoor air temperature was 100°F, and the temperature inside the building was 102.5°F, surface temperature reductions were: 25.0°F, west wall; 42.6°F, west roof; and 41.0°F, east roof. There was little difference in the temperatures of the unpainted north end and the painted south end even though the south end was in the sun all day. In effect, the white paint put the south end in the shade. There was little difference in the effect of the two types of white paint.

With only one building available for study, it was not possible to compare directly the air temperatures in painted and unpainted buildings. However, it was possible to calculate from the test data what the air temperatures within two such unventilated buildings would be, based upon actual surface temperatures of the painted and unpainted sections. These calculations were made for three different sets of data. The air temperature in the white painted building

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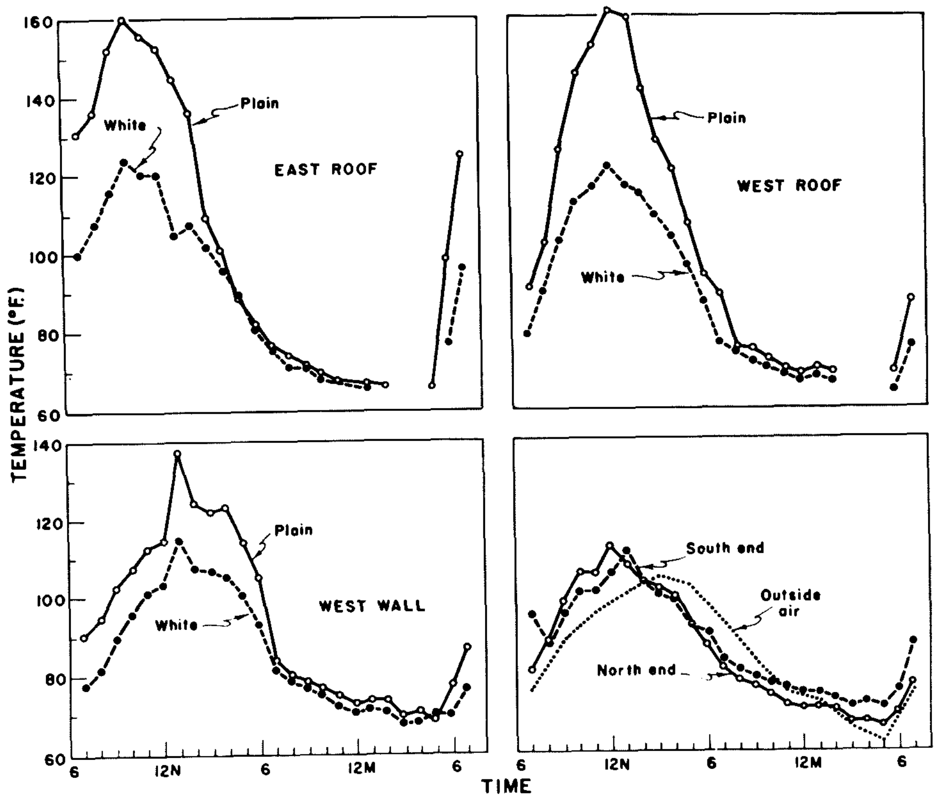
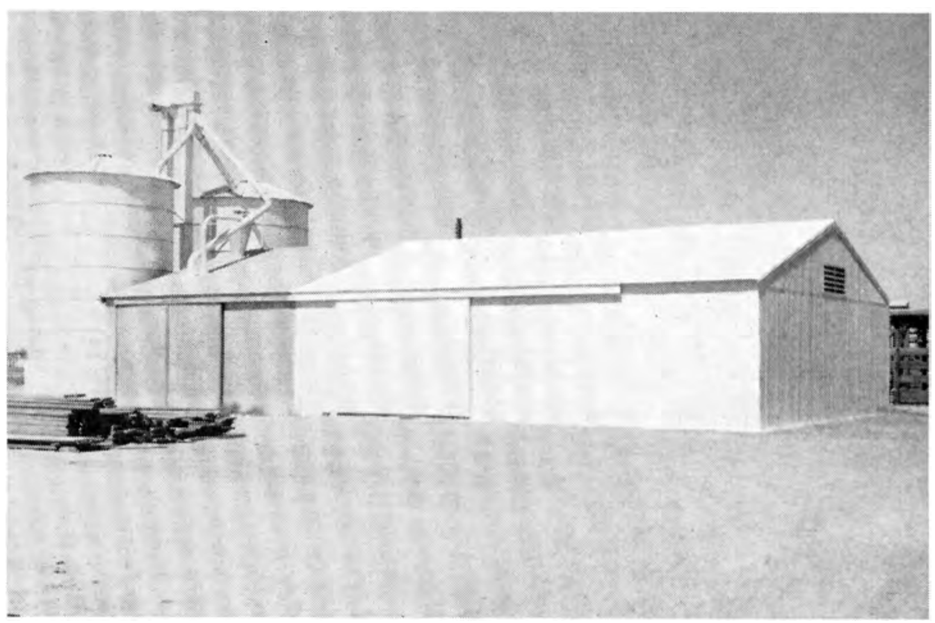
Calculated Temperature Differences Within Unpainted and White Painted Galvanized Steel Buildings Based on Actual Surface Temperature Measurements of Painted and Unpainted Sections.

Date 1955	Time p.m.	Inside air temperatures, °F		
		White	Unpainted (calculated)	Temp. Diff.
6/25 ...	1:00	102.5	130.5	28.0
6/25 ...	2:00	100.0	116.8	16.8
6/26 ...	2:00	102.5	119.8	17.3



Above—24-hour comparison of surface temperatures of painted and unpainted sections of steel storage building.

Below—Steel storage building 60′ × 32′ with sections painted white to test the effect of the paint on the thermal environment inside.



BUILDINGS

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was taken as the air temperature inside the test building, and the temperature inside the unpainted building was calculated on the basis that the amount of heat transferred to the air in both buildings was the same. Such considerations indicated air temperature differences as great as 28°F within the two buildings.

Radiation from the surfaces was measured with a directional radiometer. At 2:30 p.m. the white surfaces in shade—east side—gave off 184 Btu—British thermal units—per hour per square foot compared to 172 Btu per hour per square foot from the unpainted surfaces, indicating a more rapid emission of energy from the white surfaces. In the sun—west side—315 Btu per hour per square foot came from the white surfaces and 231 from the unpainted surfaces. The greater amount of energy from the white surfaces indicated they had both greater reflectivity and greater emissivity than the unpainted surfaces—very desirable characteristics in building heat load consideration.

Painted Animal Shades

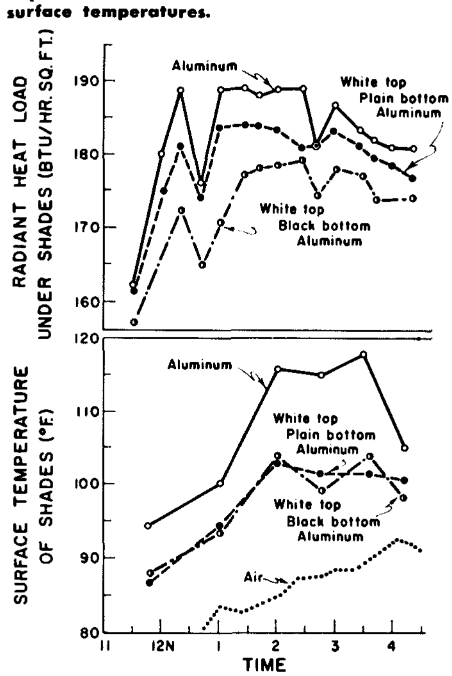
Shades are important for protecting livestock from radiation from the sun and sky and, indirectly, from the surroundings. Because the shade material is generally hotter than the surface of a shaded animal, the animal receives radiation from it.

The radiation characteristics of both surfaces of the shade material influence the radiation heat load on the animal. The characteristics of the top surface have a major influence on the temperature of the shade material; the emissivity of the bottom surface greatly affects the quantity of energy that will be emitted to the animal. In addition, the reflectivity of the bottom surface determines the quantity of incident energy from the ground that will be reflected back down to the animal.

White paint was tested as a means of reducing the temperature of metal shades to reduce the heat load on animals under them.

Three flat, portable shade frames 8′ × 8′ × 4′ high were covered with corrugated embossed aluminum roofing. One shade was left unpainted. White paint was applied to the top surface of the remaining two and the bottom of

Top—Radiant heat load under painted and unpainted aluminum shades. Bottom—shade surface temperatures.



one of these was painted with black paint. White paint and the unpainted aluminum sheet reflect about the same amount of solar energy but the emission of white paint, at ordinary shade material temperatures, is much greater. Because of this the temperature of the white painted aluminum was as much as 15°F lower than the unpainted aluminum. The radiant heat load—as indicated by black globe thermometers—was as much as 13 Btu per hour per square foot less under the white surfaced aluminum.

The third shade with the white top and black underside remained at about the same temperature as the shade with only the white top surface. However, because the black underside did not reflect energy from the ground back down to the animal, the radiant heat load under the white and black was lower than under the white shade and as much as 18 Btu per hour per square foot lower than under the unpainted shade.

The same advantages were found in painting galvanized steel shades—the surface temperature was reduced as much as 50°F by painting the upper surface white. In the tests, white painted galvanized steel shades showed an advantage over the unpainted aluminum shades.

These investigations are being continued with other building materials in order to evaluate their usefulness in protecting livestock and farm products from heat.

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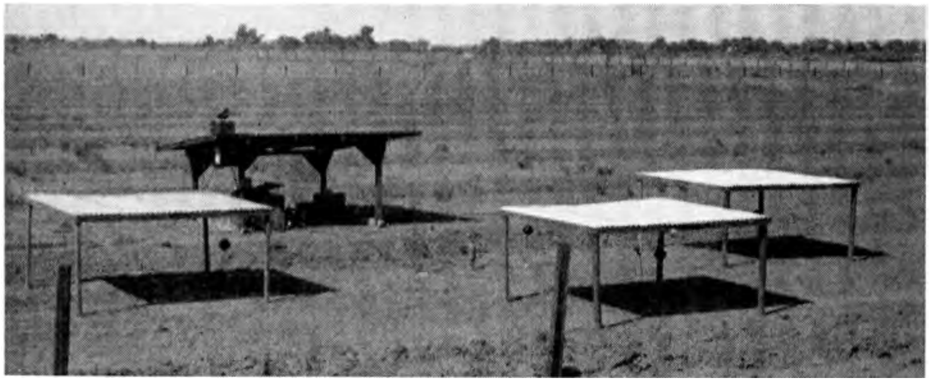
Portable 8′ × 8′ × 4′ high test shades. Black globe thermometers indicated the effect of paint in reducing the radiation heat load under the shades.



WEED CONTROL

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cheap to use, it might prove very economical for weed control in larkspur, sweet pea, and verbena.

Pre-emergence dinitro—six pounds per acre rate—gave fair weed control; however, it was toxic to the seed crop of alyssum, antirrhinum, petunia, and verbena. When this material was used at the nine pounds per acre rate, it gave good weed control but was toxic to the same flower species as at the six pounds per acre. The two flower species which showed no harmful effects from this material at either dosage were larkspur and sweet pea. Pre-emergence dinitro at the nine pounds per acre rate should prove to be a satisfactory and economical material for weed control in larkspur and sweet pea.

Chloro IPC at six pounds per acre and Alanap at three and four pounds per acre gave excellent weed control but were toxic to all seeded flower crops.

Shell 10 gave fair weed control. However, there is danger of crop injury since it is necessary to apply the spray shortly before emergence of seedlings.

The check plot was hand weeded—on April 28—about four weeks later than it normally would be weeded. Therefore, the competition from weeds in the check was greater than would be expected in a field under normal conditions. The seed yield was materially increased in all