Photosensitization of Cattle in Texas

Right—A case of winter photosensitization. The eye, nose and mouth are inflamed. The brisket has accumulated a large amount of serous fluids.

Left—The same animal 15 days later. The areas around the eyes and nose have peeled and some skin is sloughing from the dewlap.

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SUMMARY

Photosensitization in South and East Texas has been under study for 3 years. More than 50 pastures in 30 counties were included. The area studied most intensively extends from Atascosa county to Wharton county. Experimental feeding was done in DeWitt and Wharton counties. Outbreaks have occurred in Brazos, Polk, Jasper and Newton counties in East Texas and several counties on the Rio Grande Plain. These outbreaks occurred during all seasons but mostly during the spring and early summer.

All outbreaks of the disease studied occurred on pastures with a high percentage of annual grasses and weeds and a low percentage of good perennial grasses.

Each outbreak studied fitted in a definite climatic-plant growth cycle. A fair amount of moisture and growth of the vegetation was followed by a dry period. The dry periods were broken by rain and then by seasonable warm or hot weather. Large quantities of the revived, often lush growth, of the annual vegetation were consumed by cattle. Photosensitization occurred from 1 to 15 days after the rainy period. Feeding experiments, pasture analyses and related studies indicate annual grasses, both native and cultivated, are the primary causal agents.

The following recommendations for the management of photosensitized animals are based on field studies, reports of other workers and treatment records: Remove affected animals from the pasture as soon as possible and provide shade. Consult a qualified veterinarian for proper diagnosis of the disease. Follow his recommendations. Paint or spray the affected parts with methylene blue or some similar nontoxic dye; this will speed recovery and reduce the overall damage from the disease. Provide ample dry feed such as hay, straw or fodder. Mixed feeds containing leaf meal and bran also are beneficial. Anticipate outbreaks by maintaining a reserve range or pasture for rotating livestock during the dangerous period. A reserve of roughage, in the field or in storage, is valuable for emergencies or for supplemental feed.

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REFERENCES


Hurst, E. 1942. Poisonous plants of New South Wales, Sydney, N. S. W. Poison Plants Committee, 498 pps.


PHOTOSENSITIZATION OF CATTLE HAS BEEN A constant menace to stockmen in Texas for more than 40 years, and losses from this disease appear to be increasing steadily. The disease is known by several local names, the most common being “bag” or “weed” trouble. Many conditions called sandburn undoubtedly are photosensitization. The disease is produced as the result of the abnormal reaction of light-colored skin to sunlight after a photodynamic (sensitizing) substance or agent has been absorbed through the animal’s system. This substance is obtained from certain vegetation under specific conditions.

After the toxic principle has been systematically absorbed and has moved to the subdermal layers of the skin, reddening of the light-colored areas appears. Conjunctivitis usually is apparent, particularly in cattle with light-colored eyes. As the reaction progresses, the skin may exude a serous fluid, erupt into watery blisters and become yellowish, indicating jaundice (icterus). After this initial reaction, the blistered or affected skin usually sloughs, leaving raw areas which are highly susceptible to secondary infections, especially by screwworms. At the outset of the disease, the cattle are extremely sensitive to sunlight and spend most of the daylight hours under shade. Kicking, scratching, rubbing against objects and biting the affected parts are shown in varying intensities at this time. Internal disturbances, primarily in the liver, apparently are present in the early stages of the disease.

Cattle of all breeds, crosses and sexes are equally susceptible to the blistering and peeling. Nursing calves usually are not affected although symptoms have been observed in animals as young as 4 months. Fat cattle are as susceptible as those in poor condition. The udders of cows with nursing calves are subject to greater damage than those of heifers or dry cows. Predominately red or black animals become listless and show signs of disturbance, but do not blister or slough skin except on white and lighter-colored areas. Cattle of all colors may develop acute laminitis (founder) with resultant swelling of the coronary band. The animals appear reluctant to move, and when forced, walk with a high-stepping gait. Occasionally hooves may be sloughed and the animals must be destroyed. Susceptibility and severity of the disease vary among individuals.

Cattle seldom die from photosensitization. The chief monetary losses are due to loss of weight, damaged udders and secondary infections. Screwworms frequently cause secondary eye damage. If not treated, or when certain screwworm remedies are used in the eyes, the animal may become blind temporarily and sometimes suffer complete loss of eyesight. Mother cows frequently do not allow their calves to nurse because of blistered teats and painful udders, and the calves may be undernourished and prematurely weaned.

Horses, sheep and goats also have been reported with photosensitization.

Photosensitization may occur at any season of the year, but the larger and more serious outbreaks occur in the spring and summer. Most of the known outbreaks have occurred within 2 weeks following rain and during periods of rising temperature. The onset of the disease is quite sudden; few animals or the entire herd may be affected.
**Figure 1.** Crossbred Hereford cow showing poor physical condition, sloughed skin on white areas, loss of eye and a ruined udder from a severe attack of photosensitization.

**REVIEW OF LITERATURE**

New Zealand, Australia and South Africa pioneered much of the research in photosensitization of range animals which occurred under conditions similar to those in Texas. The vegetation, climatic conditions and animal symptoms found in many regions in Texas are similar to those recorded for these countries.

Clare (1952) classified a type of photosensitivity as hepatogenous photosensitivity. This most nearly fits the type encountered in this study. In hepatogenous photosensitivity, the toxic agent is a substance normally absorbed and excreted, which is diverted to the peripheral circulation through the failure of the liver or detoxicating mechanism. Jaundice usually is present in this type of photosensitivity.

Symptoms of photosensitized cattle in New Zealand described by Cunningham, Hopkirk and Filmer (1940) were similar to those shown by cattle in the present study. After post-mortem examinations, these authors reported that the liver may be swollen to several times its normal size. The left lobe usually received the most damage and sometimes atrophied and the right lobe often assumed a bulbous shape.

Many meteorological factors were studied by Cooper and Walker (1940) during outbreaks of photosensitization in New Zealand. Abnormally high air and soil temperatures were correlated with the time of the occurrences. Relative humidity, rainfall on a yearly basis and hours of bright sunshine could not be correlated. The more serious outbreaks, according to these authors, occurred after rains which ended abnormally dry periods and were followed by rising temperatures.

The research of Levy and Smallfield (1942) on the effects of soil, botanical composition and pasture management practices on outbreaks in

**Figure 2.** Dairy cows with peeling skin on white areas, udder and teats.

**Figure 3.** A Jersey cow reacting to udder irritation in the early stages of photosensitization. Loss of body weight was pronounced. The milk flow was reduced approximately 85 percent in 48 hours and did not return to normal during the 1953 and 1954 lactation periods.

**Figure 4.** Scar tissue on a Brahman cow due to blistering and peeling of the skin on a typical photosensitization case.
New Zealand showed the more serious years for the disease were associated with lush feed after drouth-breaking rains. The capability of the soil to promote rapid plant growth after rain was considered more important than soil structure or texture. Soil fertility and climate were the main factors in determining when a particular soil type was dangerous. The stage of growth of the vegetation was more important than the plant species. This was apparent as the disease occurred on pastures of widely different species composition.

Many plants produce photosensitization, and grasses are reported as the causal agents by several writers. Weather conditions, including a sequence of drouth and rain, were associated with the reported cases. Many of the same or related species of grass are common throughout the world in areas where photosensitization has occurred. Two panic grasses, *Panicum coloratum* and *P. laevifolium*, produced photosensitization in sheep in South Africa following good rains, according to Rimmington and Quinn (1937). Howarth (1931) reported the disease in California was caused by Sudangrass after it had been irrigated during hot, clear weather conditions. Britton and Paltridge (1941) concluded that a signalgrass, *Brachiaria brizantha*, in Australia was dangerous only in a particular stage of growth and only under certain weather conditions. Guineagrass, *Panicum maximum*, according to Hurst (1942) in New South Wales, was dangerous to sheep shortly after rains. Feeding of Guineagrass by Hurst in the field produced photosensitization in sheep and guinea pigs. Many other grasses are recorded as photodynamic, but specific weather conditions are required before they become toxic.

**PROBLEM AREA**

The part of Texas where photosensitization is known to occur is 50 to 100 miles wide and extends from Atascosa county on the west through DeWitt, Jackson, Wharton and Brazoria counties on the east. Outbreaks also have occurred in Brazos, Polk, Jasper and Newton counties. Records of outbreaks are known for the Rio Grande Plain counties of Live Oak, Brooks, Kleberg, Kenedy, Jim Hogg and Starr. The disease may occur over much more of East and South Texas than has been reported to date.

Photosensitization reported in cattle in Florida, Georgia and Alabama probably is of the same type as experienced in Texas. Isolated cases which may be of a similar nature also have occurred in the Midwestern States and in California.

Outbreaks of photosensitization have been reported from all continents and most of the larger islands. The consequences of large outbreaks of this malady are felt more keenly in areas where grazing is of major economic importance. Australia, New Zealand and Africa have been plagued with serious occurrences for many years.

**STUDY PROCEDURE**

In this study, four conditions were considered necessary before photosensitization would occur: natural sunlight, light-colored or nonpigmented skin, a responsible plant or plants and specific weather conditions. Therefore, the investigation of this malady revolved around the determination of the toxic plant or plants and the weather and soil conditions, and their correlation with periodicity of the outbreaks.

Rainfall and temperature data were obtained from weather stations in the areas where photosensitization had occurred and were analyzed to determine the factors which might be correlated with the outbreaks. Soil moisture and soil temperature also were taken on selected pastures which had produced photosensitization. The vegetation of pastures producing photosensitization was classified to determine the most common species. The vegetative cover and the percentage composition of the grasses were obtained by the line-transect method. Stem counts of forbs (weeds) by species were taken from 3-inch belts paralleling the transects.

Studies were made of cattle as they grazed undisturbed on ranges that had produced photosensitization. The amount of each plant grazed was recorded. Information on the life span, abundance and relative utilization was recorded for each species of the plants grazed.

Experimental feeding trials were conducted in DeWitt and Wharton counties. Animals with large areas of light-colored skin and nonpigmented eyes, udders and teats were used so that any external symptoms produced could be observed readily. The beginning and ending weights were recorded for each animal and the percentage intake of each plant fed was determined in relation to the beginning weight of the animal. All animals were placed in open, unshaded pens with fresh water available at all times. Control animals were used for all experiments and were subjected to the same treatments but were fed different rations. Practicing veterinarians in the area examined the animals at the beginning and end of each feeding period.

**DISCUSSION**

Cases of photosensitization on a large number of pastures were studied during 1952-54. Rainfall and temperature records, and the vegetational composition and growth were examined for each outbreak. These records indicate that the outbreaks occurred from 1 to 15 days after rain. The rain was preceded by a period of dry weather. The length of the dry periods varied with the soil type but they were long enough for the growth of the vegetation to become retarded and usually
somewhat wilted during the daytime. The rains were followed by increasing temperatures.

All of the native and improved pastures concerned showed a high percentage of annual grasses and weeds. The annual type of vegetation reacted readily to climatic changes and showed a marked rejuvenated growth following rains. It is under this combination of drought, rainfall and temperature that the pasture vegetation of South and East Texas causes photosensitization.

Photosensitization apparently is not limited to a particular soil type. The disease has occurred on soils ranging from deep, highly leached sands to fertile, heavy clays. It has not been possible to correlate soil temperatures and soil moisture with the outbreaks studied to date. However, it is apparent that the soil serves as a medium for expressing the weather. Therefore, the ability of the soil to induce a period of quick growth appears to be more important than a particular type of soil.

Annual and other grasses of low grazing value made up a large percentage of the vegetation of the native pastures in this study. The amount of weedy vegetation other than grasses on the photodynamic pastures also was high. One of the unexplained conditions is that not all pastures with apparently the same vegetation produce photosensitization. Nor do all pastures concerned have photosensitization every year. It is obvious that a definite combination of the conditions necessary to produce the disease are associated with the grazing behavior and possibly the physiological nature of the animal. Native pastures with a high percentage of perennial grasses and abundant forage normally do not produce photosensitization. Apparently, the carryover perennial grass furnishes considerable roughage which is used by the animal to offset the toxic condition produced by the lush growth of the annuals. Perennial grasses do not respond as rapidly in growth to moisture and temperature as annual grasses. Perennial grasses also produce more fiber than short-lived annuals. It is apparent that roughage is needed with the green feed for proper rumination. These explanations require further study.

Photosensitization has occurred on improved pastures where bur clover, annual ryegrass, oats, Sudan and rescuegrass alone, or in combination, made up the bulk of the vegetation.

Grazing studies conducted during the spring and summer of 1953 and 1954 indicated that cattle are selective in their grazing habits. Weather conditions, availability and abundance of the plants, the palatability of the plants and the physical condition of the animal appear to influence the amount of each species grazed. The grazing day—that portion of the day between first getting up in the morning and bedded down at night—was approximately 16 hours. The typical grazing day began at dawn, continued until about 10:00 a.m., began again about 4:00 p.m., and lasted until dark. Grazing continued longer in the mornings and began earlier in the afternoons on cloudy, cool days. Grazing also continued after dark on moonlit nights. Cattle drank in the morning before going into the shade and early in the afternoon before resuming grazing. Most of the ruminating was done when the animals were in the shade. Photosensitized cattle grazed mostly in the shade of trees during the sunlight hours and at night, regardless of moonlight conditions. Forbs made up a larger part of the diet in the spring than at any time during the period studied. However, they did not constitute more than about 10 to 15 percent of the diet. The diet of the cattle was altered by rain. This is partially explained by the fact that certain grasses and other plants that show a quick response to moisture were selected after rain. Field observations and observations of ranchmen were the basis for selecting certain species for experimental feeding.

A variety of forbs and grasses were fed in DeWitt and Wharton counties (Table 1). All forbs were ground and force-fed to the cattle with a balling gun, while the grasses were fed free choice. Supplementary feed was given the animals that roughage is needed with the green feed for proper rumination. These explanations require further study.

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<table>
<thead>
<tr>
<th>Plants fed</th>
<th>Days fed</th>
<th>No. of animals fed</th>
<th>Amount fed, ounces</th>
<th>Average % of body weight</th>
<th>Photodynamic reactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Violet ruellia, Ruellia nudiflora</td>
<td>14</td>
<td>1</td>
<td>508</td>
<td>7.05</td>
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</tr>
<tr>
<td>Whitebract woollywhite, Hymenopappus caroliensis</td>
<td>14</td>
<td>2</td>
<td>1268</td>
<td>5.66</td>
<td>None</td>
</tr>
<tr>
<td>Greater ammi, Ammi majus</td>
<td>10</td>
<td>1</td>
<td>337</td>
<td>2.80</td>
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</tr>
<tr>
<td>Texas skeleton plant, Lygodesmia texana</td>
<td>14</td>
<td>2</td>
<td>1414</td>
<td>9.81</td>
<td>None</td>
</tr>
<tr>
<td>Prostrate euphorbia, Euphorbia prostrata</td>
<td>4</td>
<td>2</td>
<td>208</td>
<td>2.00</td>
<td>None</td>
</tr>
<tr>
<td>Snow-on-the-mountain, Euphorbia marginata</td>
<td>4</td>
<td>2</td>
<td>200</td>
<td>1.72</td>
<td>None</td>
</tr>
<tr>
<td>Fringeleaf paspalum, Paspalum ciliatifolium</td>
<td>10</td>
<td>2</td>
<td>2832</td>
<td>26.41</td>
<td>Mild</td>
</tr>
<tr>
<td>Junglerice, Echinocloa colonum</td>
<td>10</td>
<td>2</td>
<td>3616</td>
<td>34.76</td>
<td>None</td>
</tr>
<tr>
<td>Prairie cupgrass, Eriochloa contracta</td>
<td>10</td>
<td>2</td>
<td>3632</td>
<td>36.32</td>
<td>Mild</td>
</tr>
<tr>
<td>Southern sandbur, Cenchrus pauciflorus</td>
<td>5</td>
<td>3</td>
<td>438</td>
<td>12.55</td>
<td>Mild</td>
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<tr>
<td>Annual grass mixture</td>
<td>9</td>
<td>4</td>
<td>20720</td>
<td>71.23</td>
<td>None</td>
</tr>
</tbody>
</table>

1Approximate composition: Texas panicgrass, Panicum texanum, 80 percent; prairie cupgrass, Eriochloa contracta, 5 percent; signalgrass, Brachiaria extensa, 10 percent; junglerice, Echinocloa colonum, 5 percent.
fourth day. Scours continued for 10 days and the animals lost 35 and 50 pounds, respectively.

Two heifers fed a total of 200 ounces of snow-on-the-mountain developed similar but more severe symptoms than those fed prostrate euphorbia. The juice of snow-on-the-mountain was rubbed on the udder and teats of one of the animals but no ill effects were noted. The scours subsided after 12 days. These heifers and those fed prostrate euphorbia apparently were normal approximately 1 month after the feeding was discontinued.

Whitebract woollywhite fed to Hereford heifers produced scours. However, these animals gained in weight and developed smooth, glossy hair. Violet ruellia caused watery eyes, a scabby nose and scours after the fifth feeding. Greater ammi caused mild scours.

Four species of grass were fed to nine selected animals and an annual grass mixture was fed to four heifers. The two animals fed fringeleaf paspalum developed watery eyes, harder than normal droppings and stood with arched backs and moved about sluggishly. Two heifers fed prairie cupgrass developed extremely watery eyes, stood with arched backs and moved sluggishly. The eyelids of both animals became inflamed and one heifer developed an abnormally wrinkled, hard and dead-looking neck skin and the brand scar became inflamed and peeled off. Animals fed junglerice lost weight but showed no photosensitization reactions.

Three selected cows were fed southern sandbur. The light-colored skin area oozed a noticeable amount of serous fluid, the nictitating membrane became inflamed and mild conjunctivitis developed in one animal. The feeding was stopped at the end of 5 days because of dry weather and the drying of the grass.

By July 1954, our experiments and observations led us to the conclusion that annual plants, primarily grasses, that showed an early response to rainfall were the causal agents of photosensitization in the study area.

Plant collections from more than 50 pastures which produced photosensitized animals showed that annual species, primarily grasses, were the only plants common throughout.

Photodynamic reactions were obtained from three grasses fed during 1953 and 1954.

Several grasses and forbs determined as photodynamic by investigators in other areas were present or had related species in the pastures studied.

A feeding experiment was planned in Wharton county for July 1954 to include several of the annual grasses prominent at the time. Four
cows were selected and arrangements were made to start feeding immediately following the first rain. Since July was without rain in Wharton county, annual grasses were collected in cultivated fields. Although the grasses were quite mature, large amounts were fed without other forage. The animals gained weight during the feeding period but showed no symptoms of photosensitization.

Certain facts became evident following the feeding experiments. It is extremely difficult to collect a quantity of a given species of grass and keep it in a turgid state long enough to feed as representative of range conditions. Although the grasses were sprinkled before the feeding time, normal wilting changed their conditions so that they were not in the state naturally grazed. Furthermore, annual grasses mature rapidly and toward the end of all feeding periods, the grasses had passed the lush stage of growth normally assumed following rain. Even though some preliminary symptoms were obtained, the growth stage which produces photosensitization had passed before a feeding period could be completed.

PREVENTION AND TREATMENT

The prevention of photosensitization among cattle is difficult since its occurrence cannot be predicted accurately. A study of the general pasture conditions, rainfall and temperature shows a definite pattern in relation to outbreaks. Spring and summer are more prone to have large-scale outbreaks than fall and winter. An intensive range improvement program should be started on native grass problem pastures. Such a program would include reduced stocking, deferred or rotation grazing and other soil conservation practices designed through careful planning to develop a good percentage of desirable perennial grasses in the pastures involved.

Several practices may be used as temporary precautionary measures on pastures which produce photosensitized animals. After heavy rains that break dry periods, one of the simplest practices is to exchange animals in certain pastures or to move them to a reserve pasture. When cattle are moved into new pastures, the grazing pattern is changed and consequently the diet for that period concerned is altered.

Dry roughage on lush, green pastures should be an essential part of the cow's diet. This can be provided by reserve pastures of old grass or stubble which are used in connection with the green grazing. If standing roughage is not available, hay, straw or fodder can be fed in the pasture or in drylot. Drylot feeding is advisable when outbreaks have occurred repeatedly on certain pastures. Three to 10 days of drylot feeding will get the animal through the critical period and allow the vegetation to advance in maturity.

If animals are not normally grazing parts of a pasture which have some coarser grasses or roughage, they can be attracted to the underutilized areas with salt. Since salt is commonly placed near water, these areas usually are overgrazed and weedy, thus potential hazard sites. Changing the location of salt from time to time helps to obtain a more even grazing pattern.

No specific treatment for photosensitization is known and symptoms must be treated as they appear.

Steyn (1934), in treating sheep for photosensitization in South Africa, recommended providing shade for animals as soon as the symptoms appear. Treating the affected areas with astringents, such as tannic acid, zinc oxide ointment or alum, was recommended. Steyn also considered that changing the grazing routine was essential in the prevention of photosensitization. Staining the unprotected or nonpigmented parts with nontoxic dyes such as bismark brown or potassium permanganate was suggested as a possible means of preventing skin lesions.

Gibbons (1953) applied carron oil or zinc oxide in oil to the skin lesions. The udder lesions were treated with various astringent salves.

Quinn (1938) prevented photosensitization in sheep and goats by painting them with erythrosin, rose bengal, methylene blue and methylene violet. He found that placing the unpainted animals in the sun after injecting them with certain of these dyes produced photosensitization.

Many treatments were tried throughout the study area. Some retarded healing. Applying various oils, greases and smears to the affected parts maintained the lesions in a moist condition and increased the susceptibility to flies and secondary infections. While subjected to these treatments, cattle were extremely hypersensitive, grazed very little and consequently lost weight.

Favorable results were obtained from spraying or painting the affected parts of the cattle with a solution of methylene blue and water. Methylene blue in nonirritating and apparently nontoxic. It also has an astringent effect on the skin lesions which is valuable in promoting healing and in discouraging flies and the resultant screwworm infestations.