

## A STUDY OF FREEZE BRANDING: INFLUENCE OF BRANDING CONDITIONS ON LEGIBILITY AND LEATHER DAMAGE\*

A. L. EVERETT, N. W. HOOVEN, JR.†, J. NAGHSKI, AND R. G. KOEPPEN‡

*Eastern Regional Research Center\*\*  
Philadelphia, Pennsylvania 19118*

### ABSTRACT

Traditional hot-iron branding of cattle produces large economic losses of leather, marginal legibility for ranchers, and excessive cruelty to animals. Substitution of irons chilled in a dry ice-alcohol mixture or liquid nitrogen produces permanent, white-haired brands that are relatively painless and show greatly improved legibility. Furthermore, when properly performed, freeze branding induces minimal scarring of hide tissue and thereby reduces the leather wastage produced by conventional branding.

To provide further guidelines for improving the technique of freeze branding, a comprehensive, three-year test was performed on 23 dairy cattle and nine beef animals at three geographic locations. The two refrigerants mentioned above were compared in parallel on opposite sides of each animal to evaluate three other primary variables: age at branding, anatomical area, and exposure time. Legibility of each brand was scored after regrowth of hair. Cuttability (usability) of resultant leathers was judged mostly in corrected grain finish, but partially in full grain and in splits after close inspection of crusted sides. It was shown that exposure time, age at branding, and breed type are all critical variables. Although both refrigerants gave equally good legibility, liquid nitrogen (as used after clipping) produced many more bald brands and too much tissue damage for acceptability in leather. Cuttability of the dry-ice brands ranged from about 25 percent in grain leather to over 50 percent in splits.



### INTRODUCTION

Our expanding cattle industry has a definite need for improved identification of individual animals. Accurate identification is of vital importance to breed

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†Animal Physiology and Genetics Institute, Beltsville, Maryland 20705.

‡S. B. Foot Tanning Company, Red Wing, Minnesota 55066.

\*\*Agricultural Research Service, U. S. Department of Agriculture.

improvement programs, disease control and eradication programs, and day-to-day herd management. This is especially true in the dairy industry for maintaining records of daily production, and for identification of sires in production testing programs (1).

As yet there is no ideal system for dependable livestock identification, although a number of permanent and nonpermanent methods are available which can be successfully used. Unfortunately, in many herds an adequate system of identification is a much neglected phase of the overall management program. The hot-iron brand is the oldest approach and is still considered to be the only practical method by most ranchers. Also, since it is the only legally recognized or recommended mark of ownership in many states with branding laws, it is commonly applied several times to the same animal as ownership changes. Hot branding is particularly undesirable to the leather industry because the severe tissue damage renders the brand sites, and a diffuse area around them, completely worthless as leather. Resultant economic losses, formerly estimated at \$20 million annually (2), were updated by the Tanners' Council in 1968 to about \$50 million based on a 40 percent dockage in hide prices (3). The proportion of branded hides in the total cattle slaughter has risen to more than 50 percent (4). Additional losses to tanners from multiple brands and wasted chemicals have not been accurately estimated. Hot branding is also objectionable because of the inhumane shock to the animal and the danger of secondary infections or parasitic infestations. While some effort has been made to reduce the size and restrict the location of such brands, these attempts have not been generally successful.

It was reported in 1949 (5) that the pigment cells (melanocytes) in rat skin could be destroyed by dry ice, with the subsequent regrowth of white hair. Dr. R. K. Farrell (USDA) began to explore the application of this principle for animal identification and reported his first systematic studies in 1966 (6). Thus it was that "freeze branding" was born, and Farrell secured a patent on the "cryogenic" process in 1968 (7). In a co-operative study with this Laboratory (8) it was shown histologically that the extent of tissue and leather damage was quite variable in different freeze brands but was far less severe than with hot branding.

Following this initial development, further USDA studies to determine optimum conditions for proper application of this promising method were continued by Hooven (1, 9-11). Based on a large number of practical tests, recommended procedures were made available to cattle growers (11) for three different systems: 1) irons chilled in dry ice-alcohol, applied to closely clipped surface; 2) irons chilled in liquid nitrogen, applied to coarsely clipped surface, or 3) applied to unclipped surface. Longer exposure time is required with increasing age, and beef breeds need slightly longer time than dairy breeds. The liquid nitrogen method is faster and is generally preferred in this country, but this entails a greater risk of severe leather damage when applied after clipping.

In the meantime, freeze branding is being widely used, especially in the dairy industry, and at an increasing rate each year. Custom freeze branding service has been available commercially in this country at least since 1967 (12) and in Great Britain since 1968 (13). The cost of materials for freeze branding has been estimated at about 17¢ per animal (14) or as low as 5¢ (15). Favorable reports on the use of the method have appeared in Canada (16), Australia (17), Germany (18), Italy (19), and India (20). Both small tests (12) and Experiment Station studies (14, 15) have confirmed the usefulness of the method for animal identification. One report (14) claimed 98 percent legibility on beef cattle, while a survey on hot branding in Australia (21) indicated that only 38 percent of such brands were legible.

The situation in the United Kingdom was somewhat different. Although a preliminary report (22), comparing the tissue damage from freeze branding with that in caustic brands, had demonstrated the advantage of freeze branding, the leather industry was alarmed over the increasing popularity of freeze branding. They viewed it as the introduction of a new defect rather than a better alternative, since little or no branding of any kind had been used before. A joint conference of interested parties met in 1969 (23) to deal with the problem. It was concluded that a strong effort should be made to encourage farmers to apply brands along the edges of the hide whenever possible, where they could be trimmed off more economically, even though such locations are not ideal for rapid identification.

This report describes the results of an elaborate, three-year test designed to demonstrate the permanency of freeze brands and to measure the separate effects of the many variables involved in applying the brands. From a better understanding of these effects, we can recommend optimum procedures for use in specific situations to overcome some of the inadequacies of present practices.

## EXPERIMENTAL

### Test Design

Careful attention was given to provisions for evaluating the many variables, both natural and artificial, that might affect the legibility of the brands or the cuttability†† of the resultant leather. These variations are summarized in Table I. Since it was anticipated that dairy and beef breeds might react differently, both types were included in the test. To allow for climatic effects, trials were conducted in three different areas of the country, although these cattle groups were not balanced with respect to numbers or breeds because of availability problems. The two usual refrigerants were used for chilling the branding irons: dry ice in alcohol ( $-70^{\circ}\text{C}.$ ) and liquid nitrogen ( $-190^{\circ}\text{C}.$ ). These were tested simultaneously on opposite sides of each animal in equivalent patterns.

††The term "cuttability" refers to whether or not the brand site is judged to be completely usable in finished leather for cutting out shoe components or other products.

**TABLE I**  
**CONTROLLED VARIABLES IN FREEZE BRAND TEST**

Features	Variations Used		
Cattle Breed*	Dairy Types	Beef Types	
Geographic Area*	Maryland	Louisiana	Nebraska
Refrigerant	Dry Ice-Alcohol	Liquid Nitrogen	
Exposure Time	Ten Seconds	Twenty Seconds	Thirty Seconds
Age at Branding	Three Months	Six Months	Twelve Months
Body Area	Neck-Shoulder	Rib Cage	Rump-Thigh
Leather Type	Corrected Grain	Full Grain	Splits

\*See Table II for additional details.

With each refrigerant, exposure times of ten, 20, and 30 seconds were tested at each age and body area. Branding was done first, at each exposure time and body area, when the animals were three months old and this was repeated at ages of six and 12 months. All brands were replicated over three anatomical areas of each animal as illustrated in Figure 1. The nine brands in each area represented all possible combinations of the three ages and three exposure times,

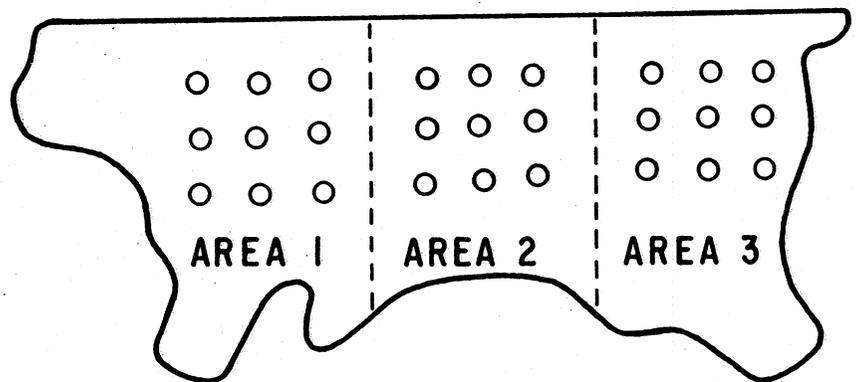


FIGURE 1.—Scheme for applying 27 circular freeze brands to each side of experimental cattle. All combinations of three ages and three exposure times were replicated in each area.

and the placement of each brand was completely randomized for each area and animal. Patterns on opposite sides were mirror images of each other. Thus there were 54 brands applied to each animal, using each refrigerant 27 times.

#### Test Cattle

The numbers of each breed type tested at each geographic location, starting in early 1967, are shown in Table II. There were three purebred dairy breeds

TABLE II  
TEST CATTLE USED AT EACH LOCATION

Breed Types	Numbers	Geographic Locations
<i>Dairy</i>		
Guernsey	3	Beltsville, Md.
Holstein	4*	Beltsville, Md.
Jersey	2	Beltsville, Md.
Swiss Crosses	5	Beltsville, Md.
Holstein Crosses	4	Beltsville, Md.
Holstein Crosses	5	Jeanerette, La.
<i>Beef</i>		
Hereford	5	Clay Center, Nebr.
Hereford x Angus	4*	Clay Center, Nebr.
	32	

\*One hide was retained in crust; all others were made into finished leather.

and one beef type, as well as some common types of beef and dairy crossbreds. The dairy crosses are designated by the sire's breed. There is an obvious emphasis on dairy types because of program needs and availability. All the beef animals were females while most of the dairy types were males, so the unlikely possibility of a sex difference was not evaluated. Four animals died during the test and are not listed. All test animals were slaughtered in 1970, about three years after the first brands were applied, to prove that the brands are permanent.

Approximately three months after each brand was applied, biopsy specimens of full-thickness hide ( $\frac{3}{8}$  inch diameter) were removed from each brand on selected cattle at each location. These were preserved in formalin solution for later histological evaluation of tissue effects, to complement preliminary information (8). A few selected animals were also biopsied shortly before slaughter to evaluate long-term healing effects. These results will be reported later.

### Branding Procedures

Details of the equipment and procedures used have been described and illustrated in an earlier report (11). With the animal restrained, the brand sites were closely clipped, brushed, and cleaned with an alcohol-soaked cloth. Immediately before applying each brand the selected site was thoroughly wetted with alcohol to prevent sticking and to enhance heat exchange. A two-inch, circular shaped, bronze alloy branding iron, previously chilled in the appropriate refrigerant, was shaken to remove excess fluid and firmly applied to the animal's hide for the designated exposure time. It is important to maintain firm, even pressure for the exact time because the interaction of time-temperature-pressure determines the final result. After branding, the iron was rechilled and the pro-

cess was repeated. To eliminate operator variation, all the brands were applied by one individual, using a staggered time schedule to comply with age and geographic requirements. This also scattered the branding sessions into every season, allowing an estimate of seasonal effects as well.

During this test it was reasoned that the excessive damage commonly observed with liquid nitrogen branding might be minimized by omitting the step of clipping the hair before branding. Consequently, a number of comparative tests were made over a period of several years which confirmed the practical value of this modification (9, 11), although leather effects have not been assessed. In general, suitable brands were produced from exposures of ten to 30 seconds (depending on age and breed), using liquid nitrogen on unclipped hide or using dry ice-alcohol after close clipping.

### **Legibility Scores**

A numerical scoring system was devised to grade each brand on the animal, after regrowth of hair, in terms of: 1) legibility from a distance; 2) the pattern of white hair in the brand; and 3) the extent of hair follicle destruction, or baldness. Average scores were derived from several observers by means of color projection slides prepared at each location. For present purposes the brands were classified as "not legible" or "legible," and the latter group was further separated into "not bald" or "bald." A bald brand is required for legibility in a white-haired area, but the baldness implies an excessive degree of tissue scarring and leather damage (8).

### **Leather Scores**

The experimental hides were commercially processed into side upper leather, stopping first at the unbuffed crust stage and including most of the splits. Each brand area was then scored by the tanner and the sides were shipped to the USDA Laboratory for another scoring of branding effects. Numerical scores were assigned to each brand in terms of: 1) brittleness causing cracks; 2) depth of scarring as it affects cuttability of splits; and 3) grain smoothness as it would be expected to affect cuttability of either corrected or full-grain finished leather. Two pairs of sides, as indicated in Table II, were retained in the crust for permanent display, leaving 30 pairs for finishing. All sides were photographed on color projection slides for later comparison with finished sides.

Six selected right sides, branded with dry ice-alcohol and representative of the different cattle groups, were returned to the tannery for finishing as full grain, along with the remaining 24 pairs of sides for finishing as corrected grain. The liquid nitrogen brands (left sides) were too severe for full grain. The finish applied was a very attractive, opaque, antique brown. Before returning the finished sides the tanner graded them for expected cuttability of brand sites. This grading was repeated at the Laboratory to derive average results.

## Acceptable Brands

Legibility of the brands on the animal and cuttability (usability) of the leather are the critical considerations for a successful branding system. The term "acceptable" is used here to signify those brands that were both legible on the animal and yielded cuttable leather as corrected grain. This avoids the errors from under-branding, where the leather looks perfect but the brand was not legible. Even when perfectly performed, freeze branding usually leaves visible impressions on the grain surface that cannot be hidden in aniline full grain. Sometimes the brands can be concealed under an opaque (pigment) finish on full grain, but the majority require a corrected grain treatment for acceptability.

## RESULTS AND DISCUSSION

### Brand Legibility

Results of dry-ice branding on the 22 dairy cattle are summarized in Figure 2. The height of the unshaded bars represents the percent of brands applied, under the given conditions of time and age, that were rated as legible. The shaded bars deal with leather effects which will be discussed later. Data from the three body areas were combined here because their variability was usually quite small. It is apparent that legibility was appreciably better at the younger ages than at 12

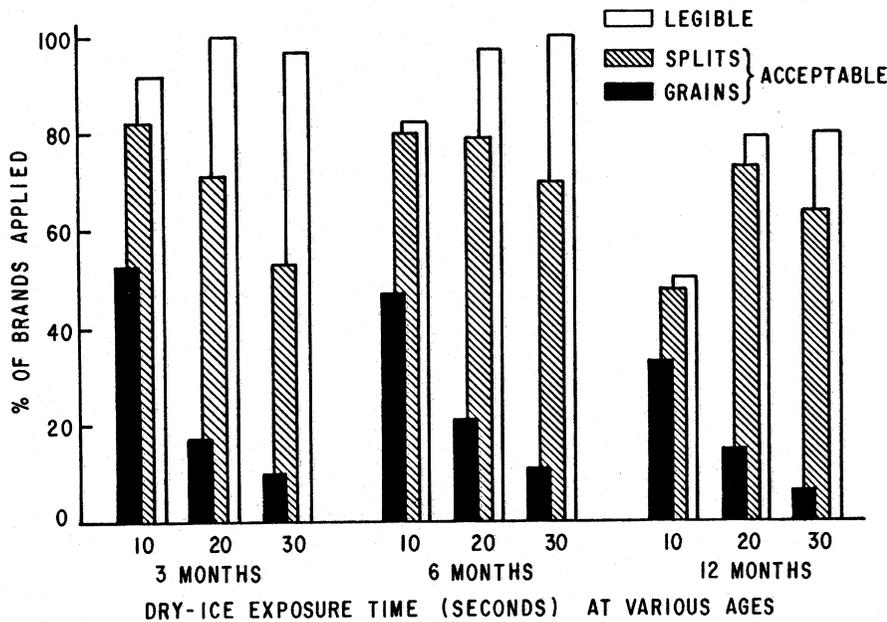


FIGURE 2.—Legibility *vs.* acceptability (see Experimental Section) of 594 dry-ice freeze brands on 22 dairy cattle. Height of each bar represents percent of total number applied under given conditions. Results were combined for three body areas (See Fig. 1).

months, and that the 20-second exposure was better than ten and as good as 30. Approximately 100 percent of the 20-second brands were legible when applied at three and six months, compared with about 80 percent at 12 months of age. Similar results for the eight beef cattle are shown in Figure 3. In this case the longest time was slightly better, with less difference due to age at branding.

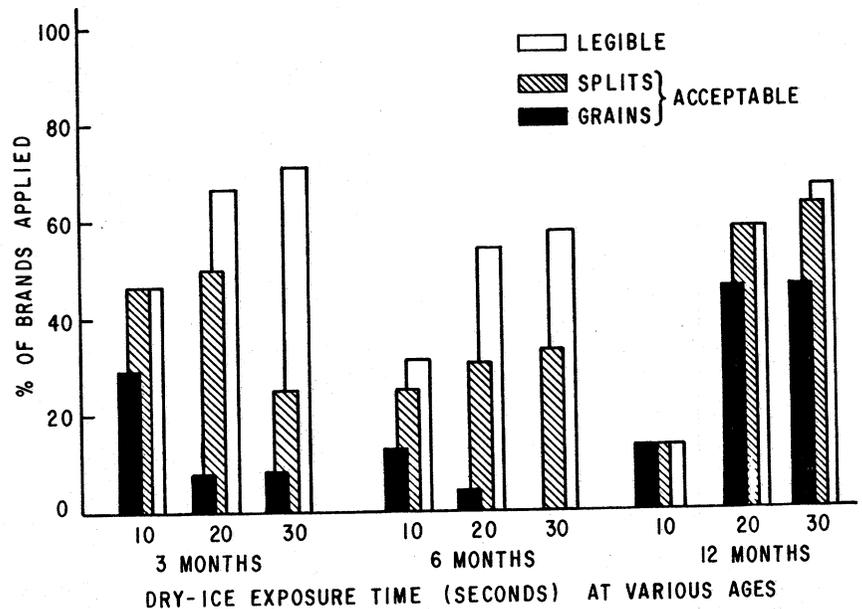


FIGURE 3.—Legibility vs. acceptability (see Experimental Section) of 216 dry-ice freeze brands on eight beef cattle. Height of each bar represents percent of total number applied under given conditions. Results were combined for three body areas (See Fig. 1).

However, compared with the dairy cattle, percent legibility on the beef animals was appreciably poorer. About 60 to 70 percent of the 30-second brands were legible overall. Perhaps the range should have been extended to 45 seconds, which was found best in another study (14).

Results of liquid nitrogen branding were essentially the same as those above for dry ice on the dairy cattle. About 100 percent of the 20-second brands were legible when applied at three and six months of age, compared with 80 percent at 12 months. With the beef cattle, 20-second brands were best at three and six months of age, showing 67 and 40 percent legibility, respectively. At 12 months the 30-second brands were best, with 80 percent being legible. Therefore the liquid nitrogen method was better for older beef cattle than using dry ice, and might have been even better at 40 seconds.

Figure 4 illustrates one of the dairy cattle branded with dry ice-alcohol at the Maryland location. This was a Brown Swiss-Ayrshire-Holstein crossbred,

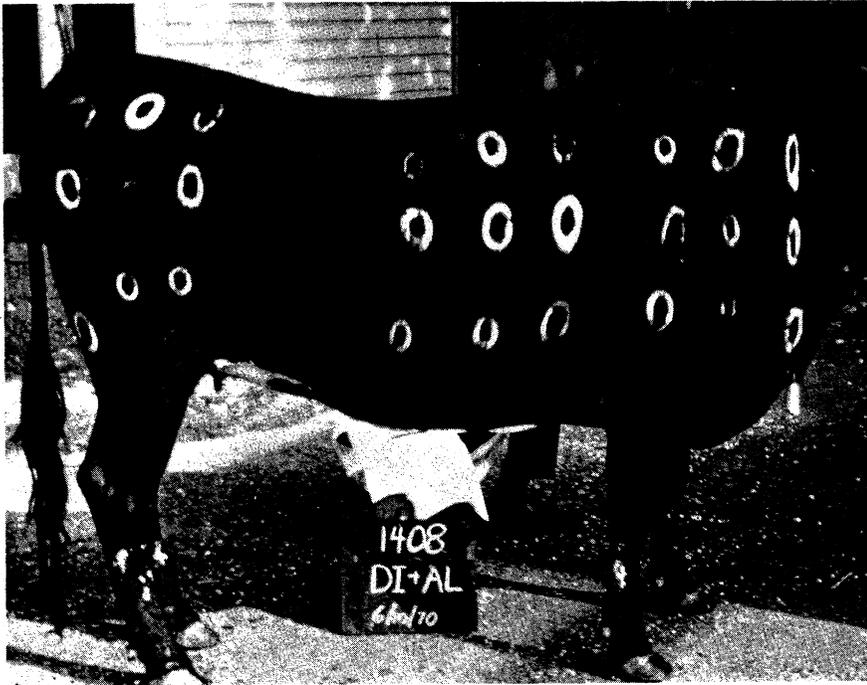
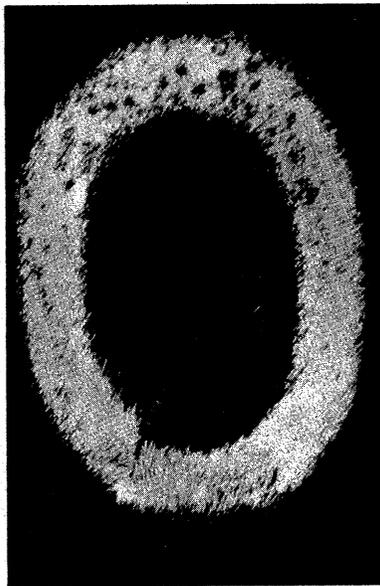


FIGURE 4.—Right side of dairy heifer #1408, a Brown Swiss-Ayrshire-Holstein cross-bred, experimentally branded with dry ice-alcohol at Beltsville, Maryland. The smallest brands, applied at 12 months of age, gave somewhat poorer legibility than the earlier ones (See also Figs. 6 and 7).

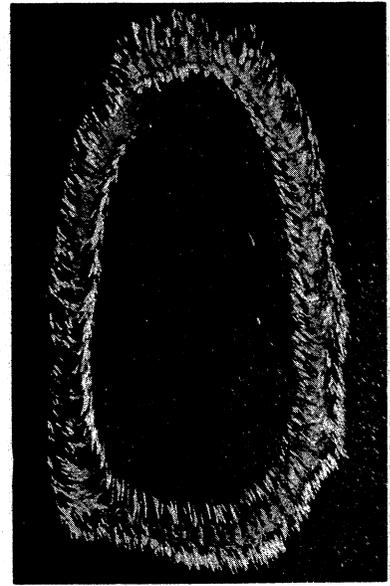
dark reddish-brown in color, photographed three years after the initial branding. The general superiority of the larger brands, applied at three and six months of age, is apparent. All were rated legible except two: the one at the tail corner and the one diagonally adjacent to it. Legibility was not as good on the light-colored breeds, such as Jersey, although in these cases it was often observed that some dark hair grew into the brands and improved their legibility. On white-haired areas or breeds, bald brands are required for legibility.

#### Bald Brands

When exposure time during freeze branding is excessive for the given temperature, the hair follicles are destroyed, the brand imprint remains bald, and there is deep scar tissue beneath it (8). On white-haired areas such brands are legible because of the absence of hair. On dark-haired areas these brands are legible because they show a fringe of peripheral white hair that outlines the brand. Figure 5A shows a closeup view of a properly applied dry-ice freeze brand, with essentially solid white hair filling the brand imprint. Figure 5B illustrates a typical bald brand produced by overexposure to a liquid-nitrogen-chilled iron



A



B

FIGURE 5.—Closeup views of freeze brands on dairy steer #932, a Holstein crossbred at Beltsville, Maryland: (A) dry-ice brand from right side showing desired result with solid white hair; (B) liquid-nitrogen brand from left side showing baldness and peripheral white hair from overexposure.

on the opposite side of the same animal. The frequency of bald brands is a function of exposure time and temperature of refrigerant. The pertinent results with the 22 dairy cattle are summarized in Table III. Legibility and baldness are expressed as percent incidence among the total number of 198 brands applied

TABLE III  
INFLUENCE OF TIME AND REFRIGERANT ON BALDNESS  
AND LEGIBILITY OF FREEZE BRANDS ON 22 DAIRY CATTLE

Exposure Time (Sec.)	Dry Ice-Alcohol		Liquid Nitrogen	
	Legible Total* (%)	Legible Bald* (%)	Legible Total* (%)	Legible Bald* (%)
10	74	9	81	72
20	92	29	90	81
30	93	41	93	81

\*Expressed as percent of total number applied (198) for each time and refrigerant, combining age and body area groups.

with each refrigerant at each exposure time. Age at branding and body area had little or no effect here. The much higher proportion of baldness in the liquid nitrogen brands is obvious and is of concern to leather interests because of its implied damage. This is the main reason for investigating the insulative advantage of omitting the hair-clipping step in branding with liquid nitrogen (9, 11). Unfortunately, the brands on the beef cattle were not separately evaluated for baldness, but results were generally similar to those with the dairy cattle.

### Leather Effects

As explained in the Experimental Section, the term "acceptable" was applied to those brands that were judged to be cuttable in the finished leather and were also found to be legible on the animal. It was also explained that the conditions chosen for liquid-nitrogen branding were fairly adequate for evaluating legibility but were too severe for satisfactory results in leather. Therefore this discussion will deal mostly with the dry-ice brands.

*Dry Ice* — Referring back to Figure 2, the shaded bars show the results for percent acceptability of various branding conditions on the 22 dairy cattle, in

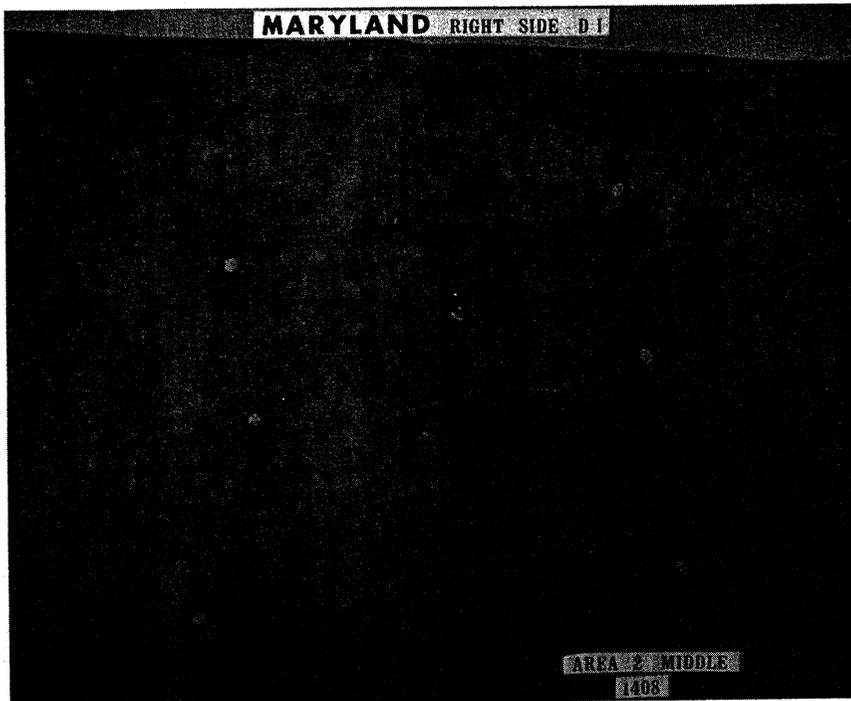


FIGURE 6.—Closeup view of upper surface, middle area, right side of split made from hide of #1408 (shown in Fig. 4). There is no trace of the nine dry-ice freeze brands whose location is indicated by the biopsy sampling holes (See also Fig. 7).

terms of splits as well as corrected grains (acceptable in full grain included). With corrected grain it is apparent that acceptability was highly sensitive to exposure time at all ages, being much better at ten seconds. Acceptability was also better at the younger ages than at 12 months. With splits, this relationship to exposure time was weaker and, in fact, was reversed with the 12-month brands, and age had little effect. The relatively high range of acceptability of the dairy splits is especially noteworthy. Figure 6 shows a closeup view of the middle area of the split made from the hide of #1408, which was shown as the living animal in Figure 4. This was one of those selected for terminal biopsy study, and the leather shows the ten sample holes (nine brands and one control) which identify the locations of the dry-ice brands. No signs of the brand imprints are visible in this area. Figure 7 illustrates the grain surface of the crust upper leather in this same area. In addition to the fact that all nine brands were legible (Fig. 4), four brands were also acceptable in corrected grain: the one in the upper left corner and the three done at three months of age. One of the latter group (labeled 3-10) was obviously faint enough for full grain also.

Referring to Figure 3, similar types of results are shown for the eight beef

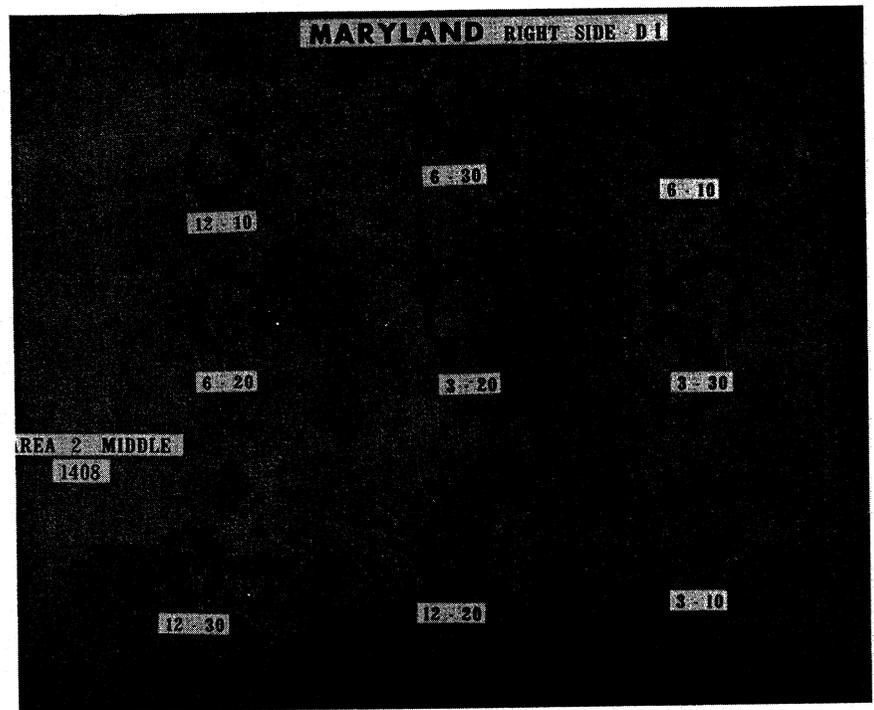


FIGURE 7.—Closeup view of grain surface of crust leather, in the same area shown in Fig. 6, made from the hide of #1408 (shown in Fig. 4). Four of the brands were acceptable in finished leather. Labels indicate age at branding and exposure time.

cattle. Acceptability in corrected grain was again much better at ten seconds for the three and six months age groups. However, at 12 months of age the longer exposure times were far better. This is explained, in part, by the limited legibility of the ten-second brands in this group. Acceptability in splits varied somewhat with age and exposure time as did the dairy brands, but the remarkable difference overall was the superiority of the longer-time brands at 12 months of age. One reason proposed to explain this difference is the greater thickness of beef hides at this age.

*Liquid Nitrogen* — Acceptability of the liquid-nitrogen brands on the dairy cattle was much lower than that of the dry-ice brands. There was little difference with age but exposure time was the primary factor. Ten-second brands had acceptability levels ranging from 15 to 24 percent in splits, while all others ranged from 0 to seven percent. Not one of these brands was acceptable in corrected grain.

Results on the beef cattle were even poorer. None of the brands applied at three or six months of age was acceptable in either type of leather. At 12 months there was four percent acceptability in corrected grain and two percent in splits. Despite these poor results with liquid nitrogen, it is better than hot branding because the better legibility allows use of smaller brands. This is dramatically

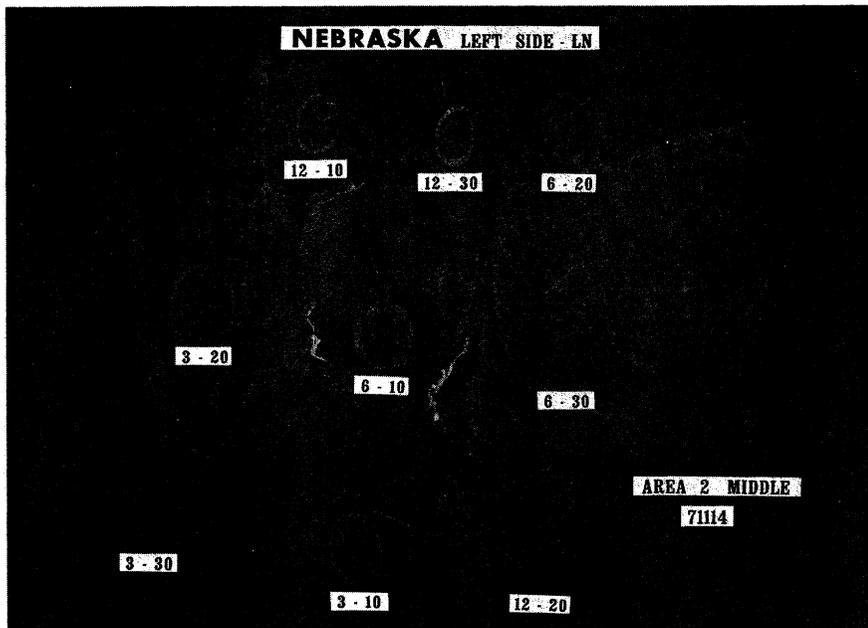


FIGURE 8.—Closeup view of grain surface of crust leather, middle area, left side, made from hide of #71114, a Hereford-Angus cross at Nebraska. Liquid-nitrogen brands were applied in the region of a large hot brand. Note the contrast in areas of leather damage.

illustrated in Figure 8. This shows the middle area of crust leather made from the hide of a beef animal at Nebraska, branded on this side with liquid nitrogen over the area occupied by a large hot brand. Although none of these experimental brands was acceptable in leather they were all legible and obviously damaged a much smaller area of leather.

*Full-Grain Leather* — Six of the dry ice-branded sides were finished as full grain, including four dairy types and two beef. These were scored better than had been anticipated from scoring the brands at the crust stage. Acceptability levels have been included with corrected grain in preceding discussions, since there were so few of these sides. Nevertheless, they are of separate interest, since 13 percent of the brands applied to the four dairy sides were acceptable and 22 percent of those on the two beef sides. It was not feasible to produce accurate black-and-white photographs of the finished leathers for reproduction in this paper.

### Minor Factors

As mentioned before, results showed little difference among the three body areas tested. There was a slight trend toward better legibility and less damage to splits in the middle area, and toward better grain leather in the rear area. However, these differences were probably not significant. Regarding the season of branding, there was a consistent, but small, improvement in legibility when seasonal averages were compared in the order: winter; spring; summer; and fall. Winter branding also gave the lowest leather cuttability, whereas brands made in the other three seasons were better and essentially alike in this respect. Comparisons among the dairy breed types (Table II) showed no important difference in legibility or effect on grain leather, although the Holsteins and Holstein crosses showed somewhat poorer results in splits. Comparison of the two similar breed groups in Maryland and Louisiana indicated slightly poorer legibility and cuttability of splits in the latter group. The two beef types in Nebraska showed essentially similar results but, of course, much poorer legibility and cuttability of splits than the dairy types.

### Optimum Branding Conditions

From review of the test data, optimum conditions for legibility, using dry ice on dairy cattle, were 20 to 30 seconds depending on age; beef cattle required 30 seconds or more. For grain leather acceptability, exposure for ten seconds was always best except for the 12-months-old beef cattle, where 20 to 30 seconds was better. Splits from dairy hides, using dry ice, were best at ten to 20 seconds, varying with age, and beef splits at 20 to 30 or more seconds. Liquid nitrogen optima for legibility on dairy cattle ranged from ten to 30 seconds, and on beef cattle from 20 to 30 or more seconds. Liquid nitrogen at ten seconds was not acceptable in grain leathers but was sometimes passable in dairy splits. Thus it

is important to select minimum exposure conditions for good legibility in order to increase the chances for acceptability in leather, since ideal conditions for both purposes are not yet available.

#### SUMMARY AND CONCLUSIONS

1. The permanency of freeze brands has been definitely established.
2. Legibility with both refrigerants was excellent (90 percent) on dairy cattle but less satisfactory (50 percent) on the fewer beef cattle tested.
3. Liquid nitrogen branding, as used after clipping, was too severe to be acceptable in leather.
4. Under the varied conditions used, 20 to 25 percent of the dry-ice brands were cuttable (usable) in corrected grain leather and some in opaque (pigmented) full grain.
5. About 75 percent of the dry-ice brands on dairy cattle and 40 percent on beef cattle were cuttable in splits.
6. Branding under optimum conditions should further improve the results reported here. Critical factors in technique are the age at branding and the exposure time and pressure for a given refrigerant and breed type.

#### ACKNOWLEDGMENTS

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#### DISCUSSION

MR. JOHN G. GREIFENEDER (Beardmore Division of Canada Packers): I would like to thank Mr. Everett and his associates for a very fine paper. As tanners we are confronted daily with the problem of brands. Very little has been done about this manmade defect. Mr. Everett has made an effort to reduce substantially the damage to the leather-making potential of hides by branding, which he estimates to cost about 20 million dollars annually. Are there questions from the floor?

MR. DAVID R. SMALL (Saco Tanning Corporation): Since branding must ultimately be acceptable to the cattlemen, how acceptable is the permanence and legibility on the range of the freeze brand? In other words, is the freeze brand permanence sufficient to satisfy the ranchers?

MR. EVERETT: Dave, do you mean permanence or legibility?

MR. SMALL: I assume you must have permanent legibility so that the cattle can be identified throughout their life span.

MR. EVERETT: Yes, the brands are desired to be permanent throughout the animal's life.

MR. SMALL: I am really interested in the overall acceptability of the freeze brand to the rancher.

MR. EVERETT: Based upon the results of this three-year test, we know that the permanence of the brand is established. The white hair resulting from the brand is continually regenerated with each hair cycle. Consequently it is as permanent as the hot brand.

Legibility means readability at a distance. In general, the freeze brand is more legible since the contrast between the white hair of the brand area and the surrounding dark hair is excellent. Also, the edges are concise and clear rather than irregular and diffuse, as observed from hot brands.

White animals require over-branding to get a bald area which is then pink against the naturally white hair. This causes additional damage, but not as much as that from the hot brand.

Overall, we feel that the legibility is improved with freeze branding.

MR. GREIFENEDER: How soon will freeze branded hides become available to the tanners?

MR. EVERETT: Some freeze branded hides are already available to tanners. I think that this availability will increase in the next few years; this is especially true since there is a commercial company now franchised to do freeze branding.

Freeze branding will be especially valuable in the dairy industry where an accurate record of identification is needed for dairy performance records. I think freeze branding will be used in the dairy industry and receive more and more use in the beef industry.

MRS. JEAN TANCOUS (Tanners' Council Research Laboratory): Will the brands be spread over the side as seen in the examples?

MR. EVERETT: No, the examples were purely experimental. We were trying to find the proper areas for branding. Location can be a serious problem; and the location should be controlled to utilize the less valuable areas of the hides, such as the flanks, and hopefully not the butt or shoulder locations.

The location depends on the use. Milking parlor use or reading of the brands on horseback on the range may require different locations. With dairy brands, at least, it should be possible to avoid the more valuable leather-making areas of the hide. It is hoped that users of freeze brands will stay away from the better part of the hide from a leather-making viewpoint. Moreover, each state is on its own on this point, so it is hard to control. However, Mr. Hooven is making field recommendations for location that take leather industry needs into account.

MR. GORDON POTTER (Tanners' Hide Bureau): What will be the rancher's and the feeder's incentive to switch from hot brands to freeze brands? Will it be the cost or the time to brand?

MR. EVERETT: Unfortunately, the freeze brand costs more and this is a deterrent to acceptance. Initially, I think the incentive will mainly be dependent upon the improved identification to the grower of his animals. An incentive due to the added value of the hides to the tanners will be slow to develop and will be dependent upon the determination by the tanner of his gains from the use of freeze brands.

MR. STUART E. MILLER, JR. (A. K. Salz Tannery, Inc.): How much longer does freeze branding take?

MR. EVERETT: Freeze branding requires from five to ten minutes when you include hair clipping and the freeze branding. If hair clipping can be avoided, using the insulating effect of the hair to lessen the extreme cold of liquid nitrogen,

hair clipping might then be eliminated, and thus cut the time. Cost should also be lessened as the process becomes commercially developed in its optimum fashion.

MR. MILLER: What estimates are there of the cost differential?

MR. EVERETT: I believe that there are figures available, but I do not remember the differential.

MR. MILLER: Would freeze branding be practicable in large feed lots (e.g., 50 to 100 thousand head) where many animals must be identified each day? Can freeze branding be done economically on a production line basis?

MR. EVERETT: While I think feed lot branding is a wasted effort, serving no useful purpose, I realize it is done. The only obvious solution to the time element is use of several operators at the same time.

MR. GUY MOBERG (Denison Hide Company): Are any experiments being done to improve the freeze branding equipment? I understand that the difficulty of carrying the equipment in the field is causing a reluctance to use freeze branding.

MR. EVERETT: Yes, there are experiments under way with portable refrigerated irons. There is one which has been commercially developed in New Zealand which weighs about five pounds. Refrigerant is circulated through the iron, instead of dipping it in the liquid. Improvements in field portability are possible, but this may increase the equipment costs somewhat.

MR. GREIFENEDER: Thank you, Mr. Everett. There is an exhibit available on the effects of freeze branding on both the grain and split leather which you may inspect later.

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