



A flavor survey of the milk produced by the Montana State College dairy herd  
by Raymond R Hedrick

A THESIS Submitted to the Graduate Faculty In partial fulfillment of the requirements for the degree  
of Master of Science In Dairy Manufacturing  
Montana State University  
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**Abstract:**

A one year milk flavor survey was made on the milk produced by the Montana State College purebred Holstein and Jersey herd, The survey began in December and continued throughout the dry feed and the pasture season until the next December, Milk samples were taken at approximately 14 day intervals throughout the year at each morning, noon and evening milking, The samples were cooled to 40°F until examined organoleptically which was within four hours after the last milking for the day was completed, The examination was made by experienced milk judges without their knowledge of the identity of the samples.

The results revealed that milk with fewer flavor criticisms Was produced when the cows were on dry feed than when they were on pasture. Feed flavor was the most predominant flavor defect found in the milk, regardless of the kind of feed. However, feed flavor was more prevalent in the Milk when the cows were on pasture than when they were on dry feed.

On the yearly average basis the flavor score of the Holstein milk was slightly Mgher than that of the Jersey milk, There was no statistical significance in the difference between the average score of the first and the following lactations-, Heithey was there any statistical significance in the average milk scores based on the age of the cows at freshening or in the average scores based on the morning, noon or evening milkings\*'

HARSONS BOND

100% COTTON FIBRE

93



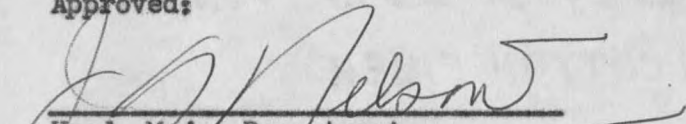
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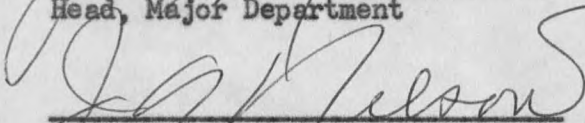
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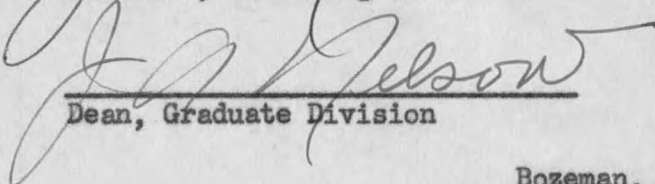
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### ABSTRACT

A one year milk flavor survey was made on the milk produced by the Montana State College purebred Holstein and Jersey herd. The survey began in December and continued throughout the dry feed and the pasture season until the next December. Milk samples were taken at approximately 14 day intervals throughout the year at each morning, noon and evening milking. The samples were cooled to 40°F until examined organoleptically which was within four hours after the last milking for the day was completed. The examination was made by experienced milk judges without their knowledge of the identity of the samples.

The results revealed that milk with fewer flavor criticisms was produced when the cows were on dry feed than when they were on pasture. Feed flavor was the most predominant flavor defect found in the milk, regardless of the kind of feed. However, feed flavor was more prevalent in the milk when the cows were on pasture than when they were on dry feed.

On the yearly average basis the flavor score of the Holstein milk was slightly higher than that of the Jersey milk. There was no statistical significance in the difference between the average score of the first and the following lactations. Neither was there any statistical significance in the average milk scores based on the age of the cows at freshening or in the average scores based on the morning, noon or evening milkings.

## INTRODUCTION

Abnormal flavors in milk constitute one of the major problems in the dairy industry. Consumers demand milk that is free of flavor defects. Both adults and children are sensitive to any off-flavor they encounter. Not knowing why milk does not have the flavor desired, consumers infer that milk with an off-flavor has been produced under insanitary conditions and is unwholesome.

Off-flavors in milk may be due to feed or to faulty production practices or to handling methods not related to sanitation. Consequently, off-flavors are often encountered in grade A milk. Nelson and Trout (113), MacCurdy and Trout (102) and Dahlberg, Adams and Held (39) reported that a high percentage of all market milk that is examined organoleptically is criticized for off-flavor. These investigators also reported that feed flavor is the most predominant.

A flavor defect in milk may also be the cause of a like flavor defect in any dairy product made from it. In order to improve the flavor of all dairy products to make them more acceptable to consumers, milk flavors should be given more attention. To ascertain the general occurrence of milk flavor defects in milk produced in a reasonably well managed dairy herd, this study was undertaken.



## REVIEW OF LITERATURE

### FEED FLAVORS

Alfalfa. Roadhouse and Henderson (130) and others (3,11,127, 128,129) reported that when alfalfa was fed as green pasture or as silage five hours before milking, it produced an off-flavor in the milk. The feed flavor in milk was more pronounced when alfalfa was fed two to three hours before milking. A pronounced feed flavor in the milk resulted when 20 to 25 pounds of freshly cut green alfalfa was fed to the cows two hours before milking. Gamble and Kelly (53) and MacCurdy and Trout (103) stated that when 15 to 20 pounds of alfalfa silage was fed immediately after milking there was no resulting off-flavor, but where only 0.4 pound of alfalfa silage was fed to the cows one hour before milking there was an off-flavor in the milk.

Clover. Roadhouse and Henderson (131) and other workers (46, 81,100,110,129,131,144,167) stated that clover hay, clover pasture, clover silage and other legumes had the same effect on the flavor of milk as alfalfa hay, pasture and legume silage.

Grass. Roadhouse and Henderson (131,132) found that when cows were pastured on sudan grass during the interval between the morning and evening milking, there was no objectionable flavor in the milk. Davies (45) stated that the quantity of milk produced was not affected when the cows were taken off pasture to control feed flavor for three

hours before milking. Other workers (20,55,57) reported grass silage of good quality, with molasses added, fed to dairy cows immediately after milking resulted in milk of good flavor. Other investigators (51,82,89) found that when silage of good quality was fed immediately after milking no silage flavor occurred in the milk.

Corn. Gamble and Kelly (53) and others (32,57,83,103,128,131) noted that when 0.79 pounds of corn silage was fed one hour before milking it produced an off-flavor in the milk. When 15 to 25 pounds of corn silage was fed immediately after milking no off-flavor was encountered. Babcock (11) stated that when dairy cows were fed 25 pounds of green corn one hour before milking, slight off-flavor appeared in the milk.

Soybeans. Gamble and Kelly (53), Woll and Humphrey (166) found that soybean silage fed to cows after milking caused an undesirable flavor and odor in the milk, but soybean silage may be fed to dairy cows when small amounts are mixed with corn silage immediately after milking without affecting the flavor. Williams and co-workers (163) and others (21,52,114,116) stated that when a ration containing up to 25 per cent of soybeans (whole, cracked or ground) or soybean hay was fed to cows, no undesirable flavor was observed in the milk.

Beets and Beet Pulp. Wing and Anderson (165) and others (16, 58) stated that dried beet pulp fed in liberal quantity one to two hours before milking had practically no effect on either the flavor or odor of the milk. Reece (126) and other workers (16,164) noted

that sugar beets can be fed to the dairy cows one to four hours before milking with practically no effect on either the odor or flavor of the milk produced. Trout and Taylor (157) concluded that sugar beet tops do not affect milk flavor unless more than 25 pounds per day are fed. Davies (44) and Granfield and Mackintosh (38) reported that when more than 9 lbs. of dried beet pulp containing molasses was fed to each cow per day, a fishy taint in milk was noticed.

Potatoes. Keyes and Nelson (87) and other workers (9,13,46, 47,164) found that dairy cows fed potatoes with the concentrate during milking did not impart an off-flavor to the milk.

Cabbage. According to Babcock (13), when a dairy cow consumes 14 lb. of cabbage one hour before milking she will produce milk having an off-flavor and odor. If fed immediately after milking it takes 25 pounds of cabbage to produce a like result.

Concentrate Feeds. The concentrate feeds such as rolled barley, coconut meal, cottonseed meal, or rolled oats, when fed one or two hours before milking, may produce a very slight off-flavor but not enough to make the milk undesirable to the average consumer. Five to seven pounds of wheat bran fed one hour before milking tends to improve the flavor of milk according to Roadhouse and Henderson (130). Trout and Horwood (159) stated that balbo-rye pasture did not have as adverse an effect on the flavor and odor of milk as did common rye.

Miscellaneous Feeds. Tarassuk and Roadhouse (150) and Barrett

et al (58) found that citrus pulp had about the same effect as beet pulp, with the exception that a bitter flavor frequently appeared in the milk when cows were fed over five pounds of dried orange pulp one hour before milking. Woodward and co-workers (168) noted that the feeding of prickly pear had no appreciable effect on the flavor of the milk. Olson and co-workers (117) reported that feeding tankage in the grain ration up to 50 per cent by weight had no effect on milk flavor even when fed one or two hours before milking. Lindsey, Holland and Smith (99) recorded that the feeding of distiller's grains or brewer's grains to cows would not adversely affect the flavor of the milk. Sunflower silage has no objectionable flavor effect according to Arnett and Tretsven (8). Babcock (12,15,16) discovered that green oats, green peas, pumpkins and carrots fed to cows either before or after milking in quantities up to 30 pounds had only a slight effect on the flavor and odor of the milk produced. When dairy cows were fed up to 30 pounds of green cowpeas, green rye, kale, rape or turnips one to two hours before milking, a slight to pronounced off-flavor resulted. Thirty pounds of these feeds consumed by cows after milking had no effect on the flavor of subsequent milkings.

#### WEED FLAVORS

Weed flavors and odors found in milk are apparently closely associated with feed flavors. Some kinds of weeds mixed with the hay, pasture weeds, weeds in silage and some weed seeds in the concentrate

cause off-flavor in milk if a sufficient quantity is consumed by the cow. This is especially true if consumed a short time before milking.

Aurand and Moore (10) stated that three different commercial mineral supplements, advertised to prevent weed flavor in milk, when given to cows failed to prevent off-flavors.

Tretsven and Nelson (155) found that ground fanweed seed eaten immediately after milking in amounts up to eight per cent of the total grain ration resulted in no off-flavor in milk. They also reported that 12 to 16 per cent of ground wild mustard seed in the concentrate could be eaten by the cows immediately after milking without imparting any objectionable flavor to milk.

Many research workers (1,7,14,17,18,70,101,104,105,107,119,120,121,130,137) determined that "bitter" weed, "carrotweed", "horseweed", "mayweed", "ragweed", land cress, wild oats, foxtail, filaree, wild onion, wild garlic, beardtongue, boneset, buckhorn, wild tansy, marestail, wild lettuce, dogfennel and foxglove caused undesirable flavor and odor in milk when a cow consumes sufficient quantity a short time before milking.

Wylie (169) and others (1,48,107) stated that the off-flavor caused by weeds was generally eliminated when cows were taken off pasture from three to four hours before milking.

Ensiled peppergrass with molasses as a preservative, and ensiled ragweed, clover and wheat stubble with molasses, did not cause off-flavor in milk when fed immediately after milking, according to Brubaker and

Reaves (31) and Pratt (120). Ten to 15 per cent wild onion and 85 to 90 per cent mixed grass silage with 225 pounds of ground corn per ton added as a preservative, when fed to cows produced an off-flavored milk (Brubaker and Reaves, 31).

#### OXIDIZED FLAVOR

Considerable experimental work has been done in an effort to determine the causes and methods of control of oxidized flavor in milk.

According to several workers (35,41,43,82,136,152), lecithin appeared to be the constituent of milk that is affected first when oxidized flavor develops. Swanson and Sommer (146) observed that spontaneous oxidized flavor in milk may be due to the oxidation of the phospholipids fraction of the fat globule membrane. Beck, Whitnah, and Martin (22) found no relation between the frequency of occurrence of oxidized flavor and the lecithin content of the milk.

A number of research workers (22,27,28,43,63) determined that the ascorbic acid content of the milk intensified the oxidized flavor.

Brown, Thurston and Dustman (24) reported that if a cow were fed a quart of either tomato or lemon juice daily, the susceptibility of her milk to oxidation was greatly reduced.

Other research workers (22,27,35,61) stated that when a cow was fed one gram of ascorbic acid daily it decreased the tendency for the milk to develop metal-induced oxidized flavor. Also, when carotene was consumed at the rate of 350 mg per day like results were obtained.

Anderson (2) and others (29) concluded that the level of the ascorbic acid in milk when drawn is not an important factor in the production of milk with low susceptibility to oxidized flavor.

Feed as a Factor in Oxidized Flavor. Spontaneous oxidized flavor in milk is influenced by feed according to Brown, Van Landingham and Weakley (28) and others (24,43,54,61,74,161). Green feeds such as pasture grass, green alfalfa, and clover decreased the occurrence of spontaneous oxidized flavor while dry feed tended to increase it.

Hening and Dahlberg (74) found that the oxidized flavors were not influenced by the plane of nutrition. According to Brown, Van Landingham and Weakley (28) high quality alfalfa hay, together with alfalfa leaf meal, reduced the development of metal-induced oxidized flavor.

Other researchers (56,58,73) noted that legume and grass silage produced milk with more resistance toward the development of oxidized flavor than feeding corn silage, molasses treated grass silage, phosphoric acid treated grass silage, mangels, beet pulp or dried citrus pulp.

According to Anderson (2) and others (6,22,26,106,162), low carotene intake was regularly associated with milk which developed oxidized flavor, while a high carotene intake decreased the oxidized flavor in milk.

Guthrie (66) found that when four cows were fed cod liver oil,

the milk produced became oily and after standing it developed either a "goaty" or oxidized flavor.

Krukovsky, Loosli and Whiting (93) and Krukovsky and Loosli (94) discovered a significant correlation between the tocopherol content of milk fat and the ability of milk to resist the reaction that produced oxidized flavor.

Brown, Thurston and Dustman (24) showed that there was variation among individual cows with respect to the tendency for oxidized flavor to develop in their milk. If milk susceptible to oxidation is mixed with non-susceptible milk from five or more cows, the tendency was to reduce its susceptibility.

Chilson (35) found that it was not necessary for the milk to come in contact with metals or metallic salts for the development of oxidized flavor. On the contrary, Tomlinson (153) stated that no samples of milk from individual cows would develop oxidized flavor without added copper.

Guthrie and Brueckner (62) and Dahle and Palmer (43) declared that breed of cows, stage of lactation, chlorine lactose ration and leucocyte content of the milk had no influence on the occurrence of spontaneous oxidized flavor.

Corbett and Tracy (37) reported that milk produced in the early part of the lactation period was more susceptible to oxidation than that produced later in lactation. They found this to be especially true of milk from heifers.



Chilson (35) and Dahle (40) stated that the oxidized flavor was due to an enzyme action, and the enzyme action could be prevented by heating the milk to 170° F for 10 minutes. Dahle and Palmer (43) found that the plasma and serum of the milk carried the enzyme-like factor responsible for the oxidized off-flavor.

Brown, and Olson (30), Thatcher and Dahlberg (151) and Tomlinson (153) stated that an oxidized flavor can be produced chemically without the aid of an enzyme. Further evidence was given that enzyme action was not involved in the production of oxidized flavor.

Roland and Tribler (136) and Corbett and Tracy (37) declared that there appeared to be no correlation between the development of oxidized flavor and the percentage of fat in milk.

Beck, Whitnah and Martin (22) observed that there may be a correlation between color intensity of the milk fat as produced by different breeds of cows and the development of oxidized flavor. The oxidized flavor was more prevalent in milk that was below breed average in fat color intensity.

Krukovsky, Loosli and Whiting (93) stated that there was a significant correlation between the tocopherol content of milk fat and the ability of milk to resist the reaction that involves ascorbic acid oxidation, which produced oxidized flavor.

Gone and Babcock (36) and others (6,18,42,95,136,154,161) reported that the growth of bacteria in milk may retard the development of oxidized flavor in raw milk.





















































































