Windbreak protection for wintering calves

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Many northeastern California cattle are wintered in fields and open lots without shelter. More weaner calves are being fed through the winter, and inasmuch as feed is expensive, reduced performance because of cold stress can be costly. Although winters in northeastern California are not as severe as in the northern United States and Canada, where cattle are often sheltered, there is occasional cold, windy weather when cattle are under cold stress; wind can contribute greatly to that stress. For example, the "windchill" factor is considered in relation to human comfort; a temperature of 30° F accompanied by a 15-mph wind is equivalent to 3° F with no wind. Thus, natural or artificial windbreaks can benefit cattle and normally are the least costly means of providing cold weather protection. Results of three years of testing artificial windbreaks in Modoc County are reported here.

Facilities and procedures

Two lots on a ranch near Alturas were selected for tests. The lots were separated by a solid 6-foot, east-west board fence. The north lot had an additional 8-foot north-south fence and was also protected by a shed and a barn (see sketch).

Temperature was measured near the pens with a recording thermograph, and "wind run" was measured in an enclosure in each pen with a totaling cup anemometer. A wind speed of approximately 2.5 mph was required to start the cups turning. (Wind run is a measure of wind speed—above 2.5 mph—times the duration at that speed. It does not record intensity of wind.) Weather data are shown in table 1.

The calves were mixed Hereford and Hereford x Shorthorn heifers, born around mid-March. They were weaned in early November after a summer on the range and a fall period on meadow aftermath grazing. The calves were accustomed to feed and lots for a minimum of one month before each trial started. Each calf was identified and individual weights were taken at the beginning, at the end, and at intervals during the tests. The number of calves per lot varied from year to year, but considering the size of the calves tested, bunk space was adequate at all times and comparable between lots.

Feed consisted of a hay ration that was two-thirds alfalfa and one-third meadow, chopped and fed with an automatic feed wagon. The amount of hay fed was measured by a sampling technique that consisted of canvas tarps placed in the mangers immediately preceding the feeding operation. Each tarp covered an 8-foot section of manger, and three were used in each lot at each measurement. Measurements were taken at both morning and evening feedings two days each week. Immediately after the hay wagon passed, each tarp was removed from the manger, the hay thereon weighed and then returned to the manger. An effort was made to feed approximately what the calves would clean up by the next feeding. The values reported are on an "as fed" basis. Data relating to the animals are given in table 2.

Results

Table 1 shows that the windbreak lot re-

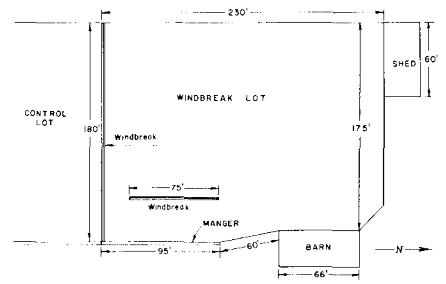
TABLE 1. Weather Data

Test	Period	Days	Mean temp °F	Mean Wind Run miles/day Control	Mean Wind Run miles/day Windbreak
1	12/12/73-3/27/74	105	35.1	8.7	4.0
2	12/19/74-4/3/75	105	32.9	9.9	5.0
3	12/16/75-3/11/76	86	34.5	7.7	3.7
Mean			34.2	8.7	4.2

TABLE 2. Cattle Numbers and Weight Gains

Test	Number of Animals Control	Number of Animals Windbreak	Average Weight, lbs. Initial	Average Weight, lbs. Final
1	59	40	429	534
2	95	55	422	531
3	92	49	410	495

TABLE 3. Performance Data						
	Mean Daily Feed Intake, lbs.		Mean Daily Gain, lbs.		Lbs Hay/lbs. Gain	
Test	Control	Windbreak	Control	Windbreak	Control	Windbreak
1	22.22	18.58	0.96	1.05	23.15	17.70
2	15.14	13.72	1.06	1.06	14.28	12.94
3	12.56	12.24	0.90	1.02	13.96	12.00
Mean	16.64	14.85	0.97	1.04	17.13	14.21



Sketch of experimental lot where windbreak protection was tested. East-west fence (left) is 6 feet high; north-south fence (top) is 8 feet high. Shed and barn also provide protection.

duced the wind run by about one-half. Performance data (table 3) indicates the major effects of windbreaks were on feed intake and feed conversion. These effects were consistent for three years and were statistically significant at the 5 percent level. Rate of gain was not significantly affected. Evidently, animals ate more to meet the higher heat loss requirement of the more windy environment; this additional energy intake was used to maintain body temperature rather than to produce gain. Because the loss in performance was in conversion rather than in weight gain, later compensatory growth probably cannot be expected to recover the loss.

Costs of building a windbreak can vary considerably, as well as costs of hay. Results from these tests however, should provide data for making a cost benefit analysis.

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High fructose corn syrup: An important new sugar substitute

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High fructose corn syrup (HFCS), a recently developed, relatively inexpensive caloric sweetener, may eventually capture up to 50 percent of the industrial sweetener market, or about 35 percent of the total caloric sweetener market. HFCS substitutes for sugar in a wide variety of manufactured commodities including bakery products, confections, processed foods, dairy products, and beverages. Since its commercial introduction in 1967, production has doubled approximately every two years. Shipments in 1978 were an estimated 2.4 billion pounds, the equivalent in the U.S. of 11.0 pounds per capita consumption. Its share of the caloric sweetener market is 8.5 percent. Growth of the HFCS industry has important economic implications to beet and cane sugar growers and processors, commercial sweetener users, corn producers, and foreign trading partners.

The product

High fructose corn syrup is a clear, sweet, low-viscosity liquid. It is high in the simple sugar fructose which differentiates it from ordinary (dextrose) corn syrup. HFCS is hygroscopic (attracts moisture) and, thus, must currently be sold in syrup form. It can substitute for sucrose in all products that do not require a crystalline structure.

It has a low potential for crystallization, often a problem in products with high solids and high sucrose or dextrose content. In some baked and frozen goods, HFCS imparts a chewy or creamy texture. It is subject to a browning reaction when heated, which is desirable in some applications (brown crust on baked goods) but undesirable in others (vanilla pudding). It contains a high level of fermentable solids and is unaffected by most temperature and acid conditions. Manufacturer representatives report that "HFCS acts almost synergistically with all fruit flavors, especially citrus bases" (*Food Engineering,* November, 1976). One major sweetener user, Smuckers, now uses 100 percent HFCS. HFCS costs less than sugar, does not mask fruit flavors but emphasizes them, and imparts excellent color and sheen.

HFCS products, currently available for commercial use, have a fructose content ranging between 42 and 90 percent. In general, the higher the fructose content, the greater is the substitutability of HFCS for sucrose. The first generation high fructose corn syrups (42 percent fructose, 50 percent dextrose, 8 percent higher saccharides) are being used in soft drinks, ice cream, jelly, sweet pickles, confections, canned fruit, and baked goods. In most products they are used as partial, rather than total, replacements for sucrose. Second generation higher fructose syrups, designed as total replacements for sucrose, are now being produced. They generally contain 55 to 60 percent fructose. In addition, at least one producer has announced an "ultra" high fructose product containing 90 percent fructose. Test results indicate that the 90 percent fructose product has very favorable properties when combined with saccharin in diet beverage and food applications (*Food Engineering,* November, 1976). These new products will undoubtedly increase the range of uses for HFCS.

Manufacturing process

While commercial production of HFCS is recent, much of the technology is not new. It was known in the 1800's that dextrose could be isomerized to fructose by treating it with alkaline catalysts at high pH. Production of HFCS was made commercially feasible when immobilized enzyme technology developed by Japanese researchers was adapted to a continuous enzyme system of production by the Clinton Corn Processing Company (a Standard Brands subsidiary).

In the United States, the production of HFCS and corn wet milling are typically an integrated process. The wet milling process separates the corn kernel into its four principal components: the germ, hull, gluten, and starch. High fructose corn syrups, as well as other corn sweeteners, utilize the corn starch slurry produced by the wet milling process as their basic input. The corn starch is passed through a mixer/heater, and a low dextrose syrup is obtained. The syrup is then filtered and decolorized using granular carbon columns. The clear, high