Livestock Agriculture: Research Incentives

Clayton Haugse

Animal products are major sources of many essential nutrients in the human diet. Research in animal agriculture has been directed to achieve optimum biological efficiency in the production of animal products. Animal protein is a high quality, complete, balanced protein, but the composition (such as muscle-to-fat ratio) of certain animal products must be altered to improve consumer acceptability in terms of current dietary standards. Research initiatives (Experiment Station Committee on Organization and Policy, Jan. 1988) suggested for animal agriculture for the next five years and that will be a part of NDSU's program are:

(1) Animal Efficiency in Food Production.

The quality of animal products for human consumption can be improved by manipulating genetic, physiological and nutritional processes to optimize feed and forage utilization and by controlling the cellular mechanisms responsible for the syntheses of animal protein and lipids. The research thrust will be to optimize biological efficiency in the production of quality animal products by improving the genetics, physiology, nutrition, health and management systems of animals.

(2) Integrating Agricultural Technologies.

The research thrust will be to develop production and marketing systems that will sustain the long term productivity and profitability of operations. Objectives will be to develop production management/decision models and expert systems that integrate financial arrangements, marketing options, production technologies, resource management practices and enterprise alternatives for animal operations; to identify input/output relationships, environmental impacts, and market potential of alternative crops, animal and farming systems.

(3) Interrelationships of Food and the Nutritional and Health Status of People.

The research thrust will be to improve the nutritional and health status of the population by determining the effects of food quality, bioavailability of nutrients and dietary practices on health. Objectives will be to (a) measure the effects of production, processing and preparation practices on the nutritional quality of food products, and (b) identify interactions among foods, their constituents and other substances consumed which affect bioavailability of nutrients, and develop methods for measuring nutrient concentrations in tissues and fluids.

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(4) Animal Health and Disease.

Animal diseases cost the livestock industry an estimated 20 percent of its annual gross income. These losses must be reduced in order to improve the profitability of livestock agriculture and improve the quality of the human diet. With animal production systems being intensified, there is greater need for integrated animal health programs to help assure the stability of these systems. Biotechnology offers unprecedented opportunities to develop new types of diagnostic reagents and more efficaious and safer vaccines.

(5) Productivity of Range and Pastureland.

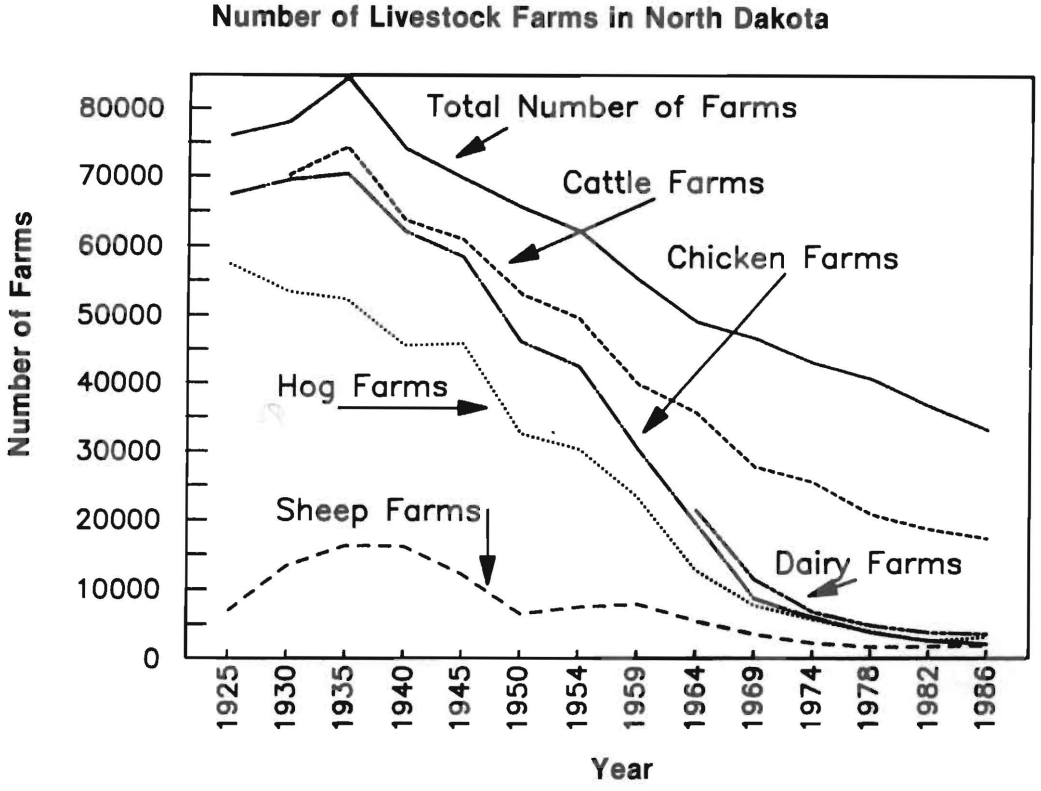
Rangelands and pasturelands comprise more than 70 percent of the land area of the United States and 33 percent of North Dakota's acreage. These grazing lands provide water, wildlife, scenic beauty and recreation, in addition to feed for livestock. The use of more efficient production systems on marginal and erosive lands could make grazing of forage production competitive with crop production for increased productivity and reduce the likelihood of serious soil erosion.

Innovative vegetative and animal management systems can significantly increase the production efficiency on North Dakota rangelands and pasturelands. Research objectives are to identify and develop an understanding of biological and ecological concepts applicable to multiuse management of rangelands and pasturelands; develop information systems and decision models for users of these lands; determine the effects of both domestic and wild grazing animals on the morphological development and physiological functions of range and pasture plants as well as plant communities, and develop reliable, economical and safe methods of managing unwanted plants on range and pasturelands to improve production, reduce erosion and reduce annual death from poisonous plants.

Figure 1 presents the change in total farms in North Dakota compared to numbers of farms for various livestock species. It appears that the number of farms on which certain livestock species are raised has stabilized while numbers of beef cattle farms continues to decrease. Data for 1987 indicate a decrease in farm numbers for all species except sheep.

Information published in crop and livestock reports indicate yearly income from livestock averages from 22 to 26 percent of the gross agricultural income. The state average is the best single indication of livestock contributions to total agricultural income but may not indicate its importance on a county or regional basis. County agricultural income figures published by the Bureau of Economic Analysis for the six-year period 1979-1984 were combined with Agricultural

Figure 1.



Census Data (county figures) for 1964, 1969, 1974, 1978 and 1982. Data presented in table 1 are based on averages calculated from adjusted data for each county.

According to this summary, receipts from livestock average 24.8 percent of gross agricultural receipts. If we look at livestock income on a county basis, a different picture results. Livestock income exceeds cash receipts from crops in 17 counties (32 percent) and is approximately equal in two others. Income from other sources averaged approximately 15 percent in this analysis but in 1986 was greater than livestock income (23.3 vs. 22.5 percent).

Receipts from livestock sales turn over more often than crop or other sources of income and generate additional income to the state. The gross receipt multiplier for livestock is approximately 21 percent greater than for crops (4.49 vs. 3.69; Ag Economics Report No. 187). Decreases in the number of farms with livestock have a greater effect on the rural economy than decreases in crop production.

Table 1 also presents the total acres (%) in a county which is designated as pasture, rangeland, woodlands, ponds, etc. County acreage also includes public land and/or Indian land. Counties are listed according to the livestock:crop ratio (receipts from sales). Livestock agriculture is most important in counties located south and west of the Missouri River and in central North Dakota. The livestock percentage of total agricultural receipts is least in counties adjacent to the Red River and west along the Canadian border. A ratio of 1.00 indicates livestock income equal to crop income.

Livestock agriculture has been important in maintaining an economic base in North Dakota's rural communities. It is important to the state's economy to maintain a livestock economy in areas of the state which are best suited to livestock enterprises. Biotechnology is one area of research which may be beneficial to the livestock industry by providing opportunities for maintaining existing enterprises and opening the door to new ventures. Funding for agricultural research with emphasis in animal agriculture is vital for producers to succeed.

Applications of biotechnology in animal agriculture are many. Through the use of biotechnology, safer and/or more highly specific vaccines may be produced for prevention of numerous animal and human diseases. Genetic modification of animals by use of biotechnology is in progress. Performance of an animal species may be improved by insertion of specific genes into embryos. For example, the human growth hormone gene has been inserted into isolated one-cell embryos of pigs with the modified embryos placed into recipient sows. Pigs were born with the capacity to produce both human growth hormone and their own natural growth hormone.

Biotechnology may be used for production of meat animals with more desirable body composition and for improved rates of growth and yield of milk and eggs. Genetic modification of gastrointestinal bacteria may result in microbes for greater dietary fiber digestion and protein production. Growth hormone produced by genetically modified bacteria is being tested. Its use has resulted in more efficient production of meat and milk. Presently, animals are treated with daily injections but research is underway to develop techniques for long term growth hormone administration.

Long term goals of biotechnology may or will result in (1) fewer chemicals used in crop and livestock production, (2) new crop varieties which may benefit the livestock industry, (3) better efficiency of food production by livestock, (4) reduction of commodity surpluses, (5) better farm living, and (6) in meeting of human food demands.

Future profitability of animal agriculture will depend on the ability of producers to maintain competitiveness. The potential for profit hinges on economically efficient production and marketing systems and supportive agricultural, economic and international trade policies.

Increased competitiveness and profitability will require development and dissemination of new technology. Educational programs in production management, financial management, marketing and public policy must be integrated toward increasing domestic and foreign markets and profitability.

Table 1. Livestock and Crops Statistics on a County Basis.

County	Land Area (Acres)	Pasture, Rangeland etc, acres (%)	Receipts from Sales of Products: Livestock $(000)	Livestock (%)	Livestock Crop Ratio	Crop (%)	Other (%)
Sioux	705,792	78.14	16,133	64.56	2.87	22.53	12.92
Morton	1,228,928	57.22	64,316	62.73	2.45	25.59	11.68
Billings	728,960	83.91	14,661	58.26	2.19	26.57	15.16
Dunn	1,275,008	67.94	50,678	59.02	2.13	27.71	13.27
Oliver	461,312	53.08	21,901	57.60	1.89	30.56	11.84
Logan	640,320	43.59	39,816	54.36	1.66	32.81	12.83
Grant	1,066,112	52.94	43,210	53.99	1.66	32.48	13.54
Kidder	868,864	43.72	42,395	52.27	1.64	31.88	11.92
Mercer	666,560	48.59	30,579	52.75	1.56	33.71	13.54
Golden Valley	648,960	46.43	27,047	47.65	1.34	35.49	16.86
Stark	842,304	40.93	55,173	49.25	1.32	37.20	13.55
McIntosh	634,688	35.97	38,674	48.50	1.27	38.28	13.22
Bowman	744,320	54.37	29,024	44.96	1.24	36.32	18.72
Emmons	961,984	40.14	53,493	47.27	1.22	38.89	13.84
Burleigh	1,040,192	47.88	50,487	45.71	1.15	39.67	14.62
McKenzie	1,750,400	52.05	53,137	44.79	1.13	39.69	15.52
Slope	783,808	61.27	24,154	42.62	1.10	38.69	18.68
Adams	633,088	41.48	30,355	39.96	0.95	42.15	17.89
McHenry	1,202,752	33.90	60,124	40.53	0.90	45.28	14.19
Dickey	731,648	27.95	64,469	37.92	0.76	49.72	12.35
Sheridan	632,704	32.37	32,552	34.55	0.68	50.60	14.84
Foster	413,056	21.11	47,020	33.08	0.61	54.21	12.71
Sargent	545,856	24.27	53,815	32.50	0.60	54.23	13.57
Pierce	664,256	21.29	36,277	30.13	0.58	52.05	17.82
LaMoure	726,976	23.28	67,945	29.89	0.54	55.80	14.31
Eddy	406,400	29.24	27,508	28.39	0.50	56.58	15.03
Ransom	551,104	35.82	51,140	27.72	0.48	57.82	14.46
Stutsman	1,449,152	27.33	115,104	27.95	0.48	57.72	14.29
Hettinger	726,016	22.91	44,595	25.80	0.46	56.58	17.62
Wells	831,296	19.25	72,142	25.28	0.42	60.08	14.64
Mountrail	1,164,224	34.97	51,603	23.48	0.40	59.21	17.31
Williams	1,321,088	33.65	64,144	22.68	0.39	58.78	18.25
McLean	1,321,600	26.90	74,288	22.13	0.38	58.06	19.82
Rolette	584,000	26.11	33,170	21.48	0.37	57.98	20.54
Griggs	454,336	21.29	38,712	23.13	0.37	61.74	15.13
Ward	1,308,160	24.56	86,825	19.02	0.30	63.46	17.52
Nelson	636,928	15.87	52,650	17.98	0.29	62.53	19.49
Divide	831,808	26.23	38,088	16.31	0.26	63.15	20.55
Benson	897,728	23.43	59,854	17.40	0.26	66.23	16.38
Burke	715,968	25.15	32,180	15.98	0.24	66.04	17.97
Barnes	946,624	17.40	101,934	15.57	0.22	70.24	14.20
Richland	927,424	14.29	139,590	14.11	0.19	74.07	11.81
Bottineau	1,073,408	15.62	76,234	11.53	0.17	69.30	19.17
Renville	567,232	14.78	37,013	11.13	0.16	69.71	19.16
Cass	1,119,296	10.08	192,231	11.73	0.15	76.83	11.45
Ramsey	798,912	12.61	62,867	7.37	0.10	71.88	20.75
Grand Forks	920,320	11.67	133,233	7.91	0.10	80.06	12.02
Towner	667,456	12.81	51,286	5.82	0.08	74.03	20.15
Cavalier	967,488	13.23	88,426	4.92	0.07	72.25	22.83
Steele	454,528	13.67	54,023	5.98	0.07	80.04	13.98
Traill	551,040	8.41	93,905	5.49	0.07	82.19	12.51
Walsh	822,976	13.32	130,619	6.05	0.07	81.01	12.94
Pembina	719,360	11.13	110,835	4.90	0.06	82.48	12.62
State	**44,334,720**	**33.27**	**3,161,616**	**24.78**	**0.41**	**60.18**	**15.04**