Stated Preference Agricultural Grading Systems: An Application in the Export Marketing of Hay

By Allen Tyrchniewicz

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STATED PREFERENCE AGRICULTURAL GRADING SYSTEMS: AN APPLICATION IN THE EXPORT MARKETING OF HAY

BY

ALLEN TYRCHNIEWICZ

A Thesis submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

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ABSTRACT

There is a growing opinion that grading systems should be based on consumer preferences, rather than ease of sorting, or " producer-based" grades. The problem has been to establish the relative weights that consumers place on various quality attributes of the product so that appropriate grades can be constructed. This thesis proposes the use of stated preference methodology to determine the attributes of an agricultural grading system. The importance of quality attributes are determined by a conjoint analysis of consumer's preferences, that determines the weight of quality factors. Alfalfa hay was used as a case study to test this approach because there is no operating grading system for hay and the expansion of hay exports suggests that a viable grading system would be useful.

A grading system for alfalfa hay was developed using the results of the conjoint analysis of Florida horse farm operators. The proposed grading system consists of three attributes of hay that buyers consider important, leaf attachment, color and protein levels.

The four grades resulting from this study are as follows:

<u>Grade 1</u>
Leaf attachment greater than 90 percent
Colour is dark green
Crude protein greater than 20 percent

<u>Grade 2</u>
Leaf attachment between 75 and 90 percent
Colour is dark green
Crude protein is between 18 and 20 percent

Grade 3
Leaf attachment between 50 and 75 percent
Colour is light green
Crude protein is between 15 and 18 percent

Grade 4
Leaf attachment less than 50 percent
Colour is brown
Crude protein less than 15 percent

The grading system was validated with hay buyers in Florida to ensure the appropriate attributes and attribute levels were chosen. The validation survey results indicate that hay buyers in Florida believe the addition of stem size, texture and odour could improve the grading system. Nevertheless, the designed grading system does contain the most important hay attributes and that they would use it. This indicates that a good base has been established, that could be tested on an experimental basis.

The stated preference method of designing a grading system for an agricultural commodity appears to be successful. Topics for further research include: testing the grading system in markets for horse hay other than Florida; incorporating stem size, texture and odour into the base grading system; designing grading system based on the preferences of dairy producers; and researching low cost methods of transporting the hay to the distant export markets.

ACKNOWLEDGEMENTS

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Finally, I would like to thank my wife Barbara and my daughters Christine and Jessica for their support at home, without whose help this thesis would still be uncomplete.

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"Is it a tame grass?"
"It is very tame. You can walk right
up to it and it will not run away"[1]

[1] An exchange between Sir George Foster and Mr. Cockshutt during House of Commons debate, 1918.

Stated Preference Agricultural Grading Systems:

An Application in the Export Marketing of Hay

1.0 INTRODUCTION

"Is this legislation required? Are the intended beneficiaries asking for it?" (Monk, 1906, page 4008) These questions, which were raised in Canadian House of Commons Debates when Canada's very first hay grading system was in the making, are still being asked today. After almost a century of experimentation, there is no effective hay grading system in Canada. A desire for a grading system exists however, as demonstrated by the efforts to develop hay certification programs for documenting hay quality in Saskatchewan, Manitoba and Alberta. The purpose of this thesis is to review the history of hay grading in Canada, and to examine the use of stated preference methods as a technique to establish quality classifications.

1.1 Economic Problem

Agricultural commodities require grading systems to reduce the transaction costs[2] and risk of selling products internationally. Without grading systems, complications may arise because the buyer and the seller can not agree on the quality of the product. If the seller has already incurred the costs

[2] For the purpose of this study, transaction costs are defined to include all costs of moving a product from a seller to a buyer. This would include logistic costs and transportation costs.

of transportation, they may be forced to revise the agreement and accept a discounted price to salvage their committed costs. Alternatively, the buyer may agree take possession of a shipment which does not meet the individual's needs. If no agreement is attainable, the buyer and seller are forced to bear unplanned transaction costs and to experience opportunity costs. A meaningful grading system that lets buyers and sellers agree on the quality characteristics of the product is required to minimize transaction costs.

Canadian exporters of hay are negatively affected by the lack of a grading system. A reputation for consistent quality of export hay has been a chronic problem since the 1900's. As time has progressed, the situation has become more problematic because hay exports are going to more distant countries. The hay certificate systems describe the product, but they do not rank the attributes of hay in a classification system that allows buyers to purchase hay on a grade standard. In the absence of an export grading system, Canadian hay competes on a commodity basis and because of the shipping distances, it is forced to operate with small profit margins.

1.2 Research Problem

Traditionally, agricultural commodity grades have been established on the basis of production volumes, and ease of implementation with negligible, if any, consultation with the end users. Methods have been developed in business marketing that take consumer opinions of product attributes and transform

these stated preferences into qualitative rankings. This stated preference approach has not been used previously to establish criteria for agricultural commodity grades. The research problem of this thesis is to explore the stated preference methods as a means of setting agricultural product grades.

1.3 Specification of Objectives

This thesis has three objectives. The first objective is to review the history and establish the current status of hay grading in Canada. The second objective is to test whether the results of a stated preference model could be used in the development of a consumer based grading system. The third objective is to validate the effectiveness of the proposed grading system.

1.4 Scope

The Florida market for imported hay is used as a concentrated and established area to derive primary data. Florida horse owners were chosen as a specific market segment for analysis because there is a large movement of imported alfalfa hay to these buyers. This is advantageous because the horse owners are familiar with evaluating the quality attributes of alfalfa hay. The horse industry in Florida relies heavily on visual inspections and the experience of hay brokers to procure high quality supplies.

Telephone surveys and personal interviews were undertaken to collect data. The survey results are analyzed to determine the important

characteristics of alfalfa hay from the perspective of the horse owners. The results are used to develop a hay grading system that can be used in Manitoba for exports to the Florida and other southeastern markets in the United States.

1.5 Thesis Preview

This thesis is divided into six sections. The second chapter outlines the history of hay grading in Canada. The history of the Canadian hay grades is followed from 1906, when it was first initiated, to the present. Also included in this chapter is a description of the current hay grades in the United States, and the methods used in the United States to control quality standards. Finally this chapter includes a description of the provincial hay certificate programs currently in place in Saskatchewan, Manitoba and Alberta.

Chapter three reviews the purpose of grading systems. This section discusses the economics of grading, as well as the benefits and the costs of grading systems. A discussion is included about whether or not the hay certificate programs offered by the prairie provinces meet the needs of the hay producers, buyers and traders. The discussion also examines the efficiency of the Canadian hay grading systems.

Chapter four presents the theoretical framework used for the development of the grading system. This includes a discussion on consumer preferences, which summarizes some of the methods to measure the bias of the buyer towards certain attributes of a product. Chapter four concludes with

an introduction to the stated preference approach to measuring consumer preferences. This deals with the problem of converting the preferences of consumers into an appropriate grading system.

The conjoint analysis is described as a possible approach in addressing this problem in the fifth chapter. This section discusses the strengths and weaknesses of the conjoint analysis and the method of transforming the results of the conjoint analysis into grades. The survey of the buyers, which is used to collect primary data for the conjoint analysis, is also covered in this section.

The sixth chapter presents the results of the conjoint analysis, and the implications of these results for the development of a hay grading system. The resulting hay grading system is outlined in this section. Potential implementation of the hay grading system is also discussed in chapter six.

The conclusions of the thesis are presented in the final chapter. This includes a summary of the problem, the methodology and the results. The limitations of the stated preference approach are also reviewed in the conclusions.

2.0 HISTORY OF HAY GRADING IN CANADA

The Canadian government established a grading system in 1906 to regulate the sale of hay, and to enhance hay exports. The hay grading system was included in the Inspection and Sales Act, which governs the sale of most agricultural commodities that are not included in their own distinct act. Although the hay grading system has been changed subtly, and became a separate Act in 1933, the bulk of the 1906 system is still technically in place.

2.1 Canada Before Hay Grades

In the late 1800's, Canada began exporting hay to the United States and overseas markets. In 1901 Canada exported 252,977 tons producing a revenue of $2,097,882 (Beauparlant 1906). This hay was shipped to Africa, Great Britain and the United States. Beauparlant reports that three percent of the hay shipped to Africa as feed for army horses, was judged unacceptable. A greater percentage of the shipments to the United States were considered unacceptable, but no direct figure is mentioned. Although shipments to Great Britain appeared to be acceptable by the consumer, politicians in Canada began to worry about the country's reputation.

The politicians did not feel that it would be necessary to develop a grading system for local markets. However, with the development of the grading system for export markets, it seemed reasonable to include local markets to better protect the consumers and the producers (Beauparlant,

1906). Several examples of Quebec localities desiring a hay grading system were cited by Beauparlant.

2.2 Canada's Demand for a Grading System

The demand for high quality hay in the early 1900's was related to the amount of feed required by horses. During the period, horses were used for transportation of people and freight in towns and cities, as well as the rural areas. Like the horses, feed supplies in the cities had to be purchased from surrounding farms. The large volumes required in the cities led to the demand for a grading system to improve the quality of hay sold, and to reduce the transactions costs.

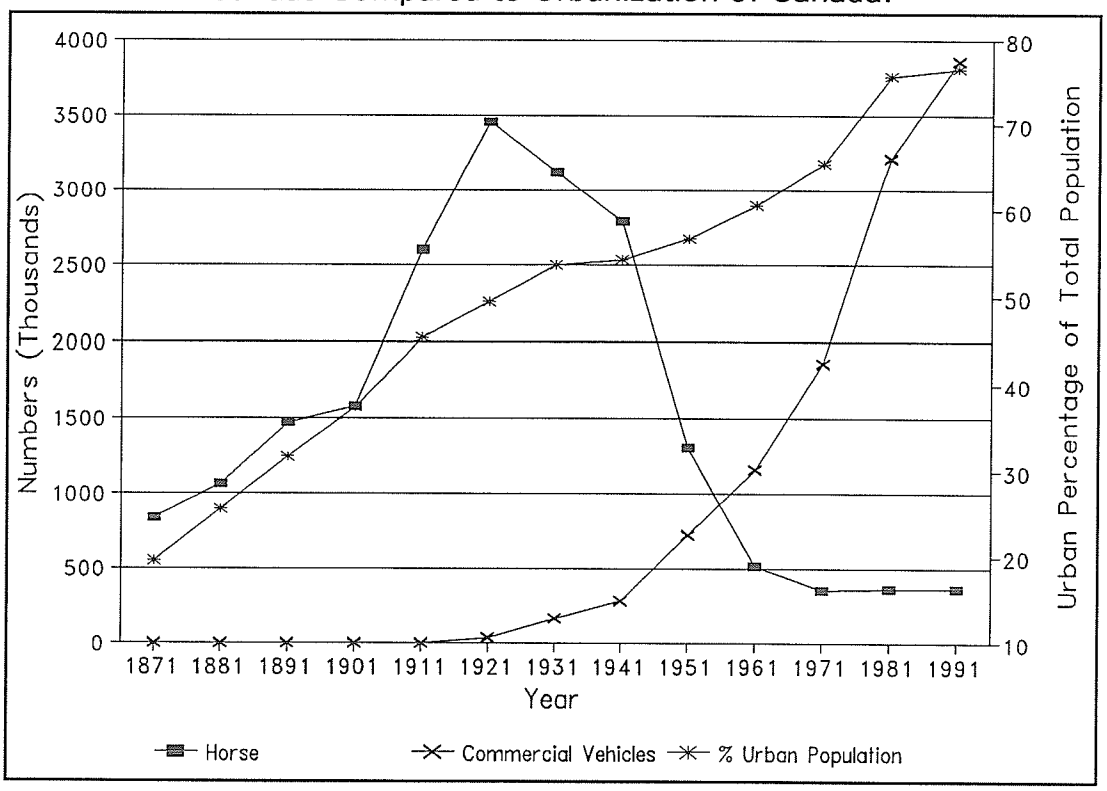
Surprisingly, data on the number of horses located in cities and towns is not available. Given that the number of horses on farms and in the cities should follow similar trends, the on-farm numbers can be used as a proxy. Figure 2.1 shows the population trends of horses from 1871 to 1991.

Between 1901 and 1921, horse numbers more than doubled. Although this reflects the expansion of agriculture in Western Canada, it is also related to the growing urbanization of the country. The percentage of urbanization increased approximately 6 percent every year until 1931. Between 1931 and 1941 the growth of the urban population was negligible, but increased rapidly until 1981 to 76 percent of the total. With the introduction of motor vehicles, horse numbers began to fall, but even as late as 1941, there were still large

numbers of horses on farms. By 1951, the numbers had dropped to below the 1901 level. With the increased use of motor vehicles for transportation, the demand for horses decreased. This in turn resulted in a lower demand for hay.

The history of hay grading systems in Canada parallels the trends which are evident in on-farm horse numbers and motor vehicles. The first hay grading system was developed in 1906, and extended to western Canada in 1918. Modifications in the administration were introduced in 1921 and 1927, but the most significant changes occurred in 1933. Since 1933, the hay grading system received only minor revisions in 1952 and 1985.

Figure 2.1 On-farm Horse Numbers and Commercial Motor Vehicle Numbers in Canada Compared to Urbanization of Canada.



sources: Statistics Canada, 1976, and CANSIM 1992

2.3 1906 Inspection and Sales Act

The Canadian government established a grading system for hay in Eastern Canada in 1906 to facilitate an easier trading mechanism for farmers and hay dealers. A member of Parliament from Quebec, Mr. A. Beauparlant appears to be the first to push for a federally regulated grading system for hay. It was Beauparlant's belief that a federal hay grading system would improve the quality of hay grown in his constituency, increase the price of hay in export markets and possibly local markets, as well as control some of the increasing dishonest trades (Beauparlant 1906).

> "The former good reputation of the Canadian hay in the United States has been somewhat damaged in late years. Why? Because certain unscrupulous dealers and farmers have, among their shipments across the border, exported bales of hay the outside of which was perfectly satisfactory but which were of inferior quality if not altogether rotten inside." (Beauparlant 1906a, p.4006)

The debate in the House of Commons questioned the need for the grading system and who would be responsible for grading the hay. The principle opponent of the bill appears to be Mr. F.D. Monk, an opposition member from Quebec, whose main argument was that the present market was operating fine and did not require fixing and that there was no public demand for the grading system.

> "There does not seem to be any general desire ... that parliament should legislate in the direction now proposed. The Hon. member for St. Hyacinthe referred to a certain convention held in his town... also that the agricultural association of the county of St. Hyacinthe merely approved the principle of the proposed law without, however,

> committing itself in any way. These are two highly respectable public bodies, the opinion of which deserves consideration on the part of this House, but which cannot be said to be the general opinion among the farmers of the province of Quebec, and far less of the country at large" (Monk, 1906 pp. 4006-4007).

Not withstanding these points from the opposition, the Parliament of Canada concluded that a hay grading system was needed, and that the federal government should provide inspectors to grade the hay.

The hay grading bill passed the third reading in the parliament and received royal assent in 1906. The hay grades established were only for Eastern Canada, and did not include the type of hay grown in the Western provinces. The Eastern Canadian hay grades were included in the Inspection and Sale Act sections 340 to 342 (Dominion of Canada, 1906). Grades were established for timothy and clover. The grades of hay are as follows:

1) *Prime Timothy* shall be pure timothy, perfect in colour, sound and well cured;

2) *No. 1 Timothy* shall be timothy with not more than one-eighth of clover or other tame grasses mixed, of good colour sound and well cured;

3) *No. 2 Timothy* shall be timothy with not more than one-third clover or other tame grasses mixed, of good colour, sound and well cured;

4) *No. 3 Timothy* shall consist of at least fifty percent of timothy and the balance of clover or other tame grasses mixed, of fair colour, sound and well cured;

5) *No. 1 Clover* shall be clover with not more than one-quarter of timothy or other tame grasses mixed, of good colour, sound and well cured;

6) *No. 2 Clover* shall be clover with not more than one-quarter timothy or other tame grasses mixed, of fair colour, sound and well cured;

7) *Mixed hay* shall be hay which does not come under the description of timothy or clover, and which is in good condition, of good colour, sound and well cured;

8) *No grade* shall include all kinds of hay badly cured, stained or out of condition;

9) *Shipping hay* shall be hay in good condition, pressed, sound and well cured.

According to the Act, Inspectors, who were appointed by the Minister of Trade and Commerce, must pass an examination of their ability to grade particular commodities. The inspectors had the option to appoint deputy inspectors to assist them in their duties. The deputy inspectors must also pass a grading test, however. The inspectors were required to collect fees for their services. The total fee was dependent on the quantity of the commodity being inspected. The rate was 20 cents per ton.

Inspections of hay products were not compulsory, unless part of the sales agreement. Hay imported into Canada did not require inspection, but importers were urged to inspect the hay to ensure the hay was of good quality. The government strongly recommended that export hay be graded, but it was still optional.

2.4 1918 Inspection and Sales Act

While Eastern Canada had a grading system, problems were arising in some of the western hay trading centres, such as Winnipeg and Vancouver. Confusion and dissatisfaction prevailed at the large trading centres, because of

the lack of standards and inspections (Foster 1918). Sir George Foster initiated the campaign for a hay grading system in Western Canada. When questioned in the parliament who had requested the legislation, Sir George Foster replied only "the western provinces".

At the same time that the House of Commons was considering the need for a grading system in Western Canada, there was discussion about modifying the existing system in Eastern Canada. The general concern appeared to be the question of who was liable for hay that did not meet the grade indicated. One Member of Parliament (MP) considered the farmer to be responsible for hay misrepresented, while another felt that the presser should be accountable. "If the hay is not up to standard the farmer should have to see that it is up to standard and not the poor devil who presses it" (Nesbitt 1918). The argument for penalizing the producer was that the presser is usually hired by the farmer to press the hay, and the producer is responsible for selling the product. The counter argument is that the presser tends to sell the product, not the farmer. "A license imposed upon these people (hay dealers and pressers) would improve the personnel and make them more careful in their dealings with farmers" (Morphy 1918). In the end, the section on responsibility was removed from the Act.

It was settled that the same grading systems could not be used across the country. Parliament decided that any problems with respect to the grades be treated in the same manner as any other fraudulent action. It was

concluded however, that the seller of the hay must affix a tag to the bale stating his name, his business address, and the weight of the bale.

The Inspection and Sales act of 1918 was amended to account for the changes to the Eastern Canadian hay grading system, and to establish new grades for Western Canada. Sections 340 to 340b of the Act deal directly with the grades of hay. Eastern Canada and Western Canada each had their own grading systems, because of the different types of hay grown in each region. Grades were designated to straight timothy, a timothy clover mix, and other prairie grasses. A detailed listing of the hay grades for Eastern and Western Canada is presented in Appendix A.

The Inspection and Sale Act also considers "pressers of hay" who sell hay in baled form. The Act specifies that the bale must be held together with wire not below number fourteen annealed steel wire, and that no foreign material can be added to the bale to increase its weight. Pressers, acting as sellers, are also required to attach tags to each bale indicating the weight, and the presser's name and address. Fines were prescribed for any violations of the above rules and regulations. Although the grading of hay was optional to the producers, it was not optional to the pressers, unless the hay was pressed on a custom basis for later sale by the farmer.

2.5 Amendments to the Inspection and Sales Act

In 1921 parliament revised the Inspection and Sales Act to have the presser's name affixed to the bale, rather than the seller's name.

The Act was not modified again until 1927, when two major changes occurred. First, the Minister of Trade and Commerce was given the power to make regulations consistent with the Act. This effectively allowed the Minister to revise the Act without further references to parliament. The second revision was the removal of some commodities included in the Act. Separate Acts were established for fruit and vegetables, and for dairy products, in order to reflect the unique nature of each commodity. This reduced the scope of the Inspection and Sales Act.

2.6 1933 Hay and Straw Inspection Act

Several provinces complained that the 1927 Inspection and Sales Act did not define the grades of hay sufficiently to protect individual hay traders. Alberta farmers argued that the grades did not limit foreign matter, such as wood and stones in the hay, which increased the weight. Hay dealers in the Quebec complained that there were too many regulations with respect to hay trading. "In regard to this measure and many others introduced by the Department of Agriculture, we find it is overdone and it is very annoying to have so many acts in regard to everything and which have no meaning"

(Lanctot 1928).[3]

A repeal was put forward by the Minister of Agriculture because of several requests to eliminate the grades in the legislation and to change the grades to better fit the circumstances. Opposition to the repeal came from Mr. A.W. Neill on the grounds that the old grading system was adequate. Another concern was the movement of power from parliament to the Department of Agriculture. "...there is a tendency for the Department of Agriculture to make the penalties for any infraction of their rules and regulations very severe, and for that reason I should like to have the regulations framed by the house and not the officials only" (Neill 1933).

The 1933 amendment to the Inspection and Sales Act repealed sections 156 to 165 that contained the grades for hay earlier established by parliament. At this point, hay and straw were removed from the Inspection and Sales Act and placed in their own distinct Act. The new Act is referred to as the Hay and Straw Inspection Act.

2.7 1985 Hay and Straw Inspection Act

The Hay and Straw Inspection Act was amended in 1952 to reword the 1933 Act, with no effective changes. The revisions remained unchanged until 1985 when the Act was modified again. This is the current legislation for hay

[3] Mr. Lanctot was a member of parliament from Quebec, and was also a hay dealer.

and straw in Canada. This legislation contains no grading system, but does give the Minister of Agriculture power to impose a grading system if it is viewed to be necessary.

Revised Statutes of Canada 1985 Volume V
Chapter H-2 1985 sections 1-3.

1. This Act may be cited as the Hay and Straw Inspection Act. R.S., c. H-2, s. 1.

2. Such inspectors may be appointed as are required for the purposes of this Act. R.S., c. H-2, s. 2.

3. The Minister of Agriculture may

   a) establish regulations prescribing standards of class, quality and condition for hay and straw;
   b) by inspection certificate, certify the class, quality and condition of hay and straw, and the inspection certificates issued by officers appointed by law for that purpose shall be accepted in the courts as evidence of the particulars therein set out; and
   c) prescribe the places where, and the conditions under which, hay and straw shall be inspected and the charges to be made for such inspections. R.S., c. H-2, s. 3. (Government of Canada, 1985).

2.8 Current Hay Grades in Canada

Effectively, there is no federal grading system for hay in Canada, and Agriculture Canada has no trained hay inspectors. The last hay inspector retired in 1990, and was not replaced (Kirkland, 1992). The disintegration of the hay grading system can be attributed to its lack of use by the hay traders, who did not find it beneficial.

In the absence of a formal grading system, sellers match the needs of the

buyers with hay in their area. At times when local hay production is limited, hay dealers expand the scope of their search to find hay that meets their buyers' specifications. These sales are based on the commercial knowledge of the seller regarding the wants and needs of buyers that has been established after many business dealings. This is one of the reasons hay buyers give for staying with the same sellers.

2.9 Current Hay Grades in the United States

The USDA hay grading system was established in 1921 to promote easier trading and exchanges (McClure 1921). Although the need for a grading system was recognized, the method was inefficient and rarely used by producers. Modifications were made to the hay grading system throughout the years, but never quite to the satisfaction of individuals in the hay industry. Very little hay was priced and sold based on the USDA grading system for hay (Helmberger et al 1981). At the current time a formal grading system does not exist.

"The USDA hay grading system has not been in use for a long time because it did not meet the needs of the producers and consumers" (Kieffer 1992). The United States government did try to modify the grading system to better accommodate the needs of the hay traders, but it was the belief of most hay producers, consumers and dealers that the government's hay grading system would not meet their requirements. For this reason, individuals, who

were involved with hay trading, lobbied to block the changes.

The reasoning for the protest against a hay grading system is hypothesized to be similar to resistance for changes to grading in the meat industry. Traders maximize their revenue by not using a grading system. The trader does not bear most of the transaction cost, because they pass it on to either the producer or the consumer. With a grading system in place, the producer has a better idea of the value of the product, and the consumer has a better understanding of the quality of the product being received. Clearly, marketing risks are also greater in the absence of a grading system. However, for traders or hay dealers, who have a strong marketing position (i.e. monopoly) to manage risk, the opportunity exists to benefit from this lack of information.

The American Forage Grassland Council designed a grading system in the 1980's, but it has not been formalized because of difficulty in determining appropriate levels of each attribute. In this grading system, the type of forage, the maturity of the forage, the leaf attachment of the forage and the colour of the forage are included, along with a chemical analysis which provides information on crude protein, acid detergent fibre, neutral detergent fibre, and net energy levels for the forage. Six grades are included in the system: prime, one, two, three, four, and five. Prime is the best quality with the other grades following in descending order, in terms of quality.

Some of the larger consumers of hay have either developed or have borrowed grading systems to promote easier trading. For example, Masstock

Dairies (Georgia), with a consumption of 50,000 tons of alfalfa annually, use an informal grading system designed by the American Forage Grassland Council. Masstock Dairies distributes the grading system to potential suppliers and informs them of the amount paid for each grade.

The current approach to hay inspection in the United States is the use of informal grading systems. The United States government would prefer to have a uniform hay grading system across the country, while the some users of the informal hay grading systems claim that this system is functioning adequately.

2.10 Provincial Certificate Programs

Canada has gone a different route than the United States with respect to hay inspection. The current trend in hay inspection is for provincial hay inspection certificates. Although the hay certificates do not provide a grade for the hay, they do provide all the information necessary to establish the quality of the hay, and much of the information required for a grading system.

In 1989 the Saskatchewan Forage Council (SFC) surveyed Saskatchewan consumers and producers of hay to determine if a hay grading system was required (McLean 1991). The survey results indicated that 85 percent of the respondents were in favour of a hay grading system to improve the consistency of hay quality for sale and for purchases. A volunteer certificate program was established that allowed producers to have their hay graded based on

description of the hay lot and a chemical analysis of the hay. A hay lot is made up of a consistent bundle of hay and is not restricted in size or tonnage. The lots can be very large or small, depending on the consistency of the quality. The certificate system specifies the quality of some hay attributes, but has not taken the next step and classified the hay according to consumer demands. As of January 1991, only 73 lots of hay had been inspected in Saskatchewan, and of those, 60 were available for sale. Although the certificate program allows the producers to ascertain the quality of their hay, they are not obligated to divulge the information to the purchasers.

Manitoba and Alberta are in the process of implementing similar certificate programs for hay. The Manitoba hay certification program has been operational since March 1992, and has been requested to certify 20 lots of hay. A copy of the Manitoba Forage Council Hay Certificate Program worksheet is presented in Appendix B. The Alberta hay certificate program is not yet operational.

The Canadian Forage Council is in the process of determining the demand for a Canadian hay certificate program. This would make a uniform certificate program available across Canada.

The certificate program would likely work well as a marketing tool in local markets, where transaction costs are low. In export markets, such as Florida, however, the higher transaction costs and the lack of trust buyers and sellers have, may inhibit the certificate program.

The hay certificate programs are the responsibility of the provinces. Currently the Forage Councils for each of the prairie provinces are operating the hay certificate programs in their jurisdictions. A fee is charged to cover the cost of the inspection and the chemical analysis, usually amounting to 75 dollars.

The inspectors for the certificate program are trained by the Forage Councils, but do not receive a salary. Their payments come from the producers who use the programs. This is a concern to users of the program. Inspectors might certify hay just to make money. Most of the hay certified is destined to be used in export markets. Should the inspectors certify the hay as better than it is, in order to encourage use of the program, producers would have trouble in export markets. Since the inspectors are usually individuals associated with a government agency (e.g., forage specialists or weed inspectors) it might be more appropriate to include hay certification in their job description. The producer would pay the government for the inspection, and the government would pay the inspector's salary.

The hay certificate programs do not guarantee that the information on the certificate is correct. The producer is responsible for the certificate information matching the hay for sale. Should a problem arise, the producer has no recourse against the inspector.

3.0 ECONOMICS OF GRADING

3.1 The Importance of Product Information

Better information is a key advantage in any type of transaction. When individuals conducting business in a market are uncertain about the outcome, market information is considered to be imperfect. Game theory suggests two types of uncertainty to describe market transactions; incomplete information and imperfect information (Phlips, 1988).

Imperfect information can be defined as the situation when all relevant information is available, but all of the individuals do not process the information in a similar fashion. According to game theory, imperfect information occurs when market participants are unsure of other agents' behaviour.

Hay markets provide an example of imperfect information when hay dealers or hay producers do not know what the other views as an acceptable quality standard. Both parties have the same information about hay, but are unsure how the other views the quality characteristics. This is the current problem in the Florida hay market for horses. The quality standards of hay are at the discretion of the hay dealers. The best hay the dealer has available is considered to be the best quality by the hay dealer, and as such, a premium is charged.

Incomplete information is the lack of necessary information, or in game theory, when the players do not know the rules of the game. This arises when

the buyer or seller does not have all of the information necessary to make an efficient decision. Hay buyers who do not know the true quality of a purchase from a seller suffer incomplete information.

The absence of complete information about a product's characteristics or actions of the buyers and sellers leads to a second-best equilibrium (Nalebuff and Scharfstein, 1986). This occurs when either the buyer, or the seller, have more information about the product and are not willing to share this information. The other individual will receive a worse deal than if they knew all the information as well. The best equilibrium between price and quality for the buyers and sellers requires perfect information on both sides. It is evident that, having more information available to the buyer and seller, the overall efficiency of the market would improve. Trading could be conducted more quickly and transaction costs would be lower.

"In the uncomplicated world of the idealized competitive economy, there are only two types of information that the consumer is presumed to need ... information as to prices of goods and information as to timing of receipts and payments" (Lancaster, 1981 page 17). All efficient markets are characterized by product and price information that is almost close to perfect. For consumers to make an educated decision about a purchase, they require information about the price and the quality of the product. The seller also requires information to ensure a reasonable price is received for the product. Information with respect to price is typically easily understood, and usually simple to locate. With a

monopoly or an oligopoly supply, the consumer is given a price and must decide if it is acceptable for the transaction to continue. In the hay industry, both oligopoly and oligopsony situations are present.

In oligopsony situations, the seller is confronting a small number of hay dealers, who tend to have control over the market. This is the case in the Florida hay market for horses. Although there are many horse farms in the region, most farm managers only purchase hay through the local hay dealers. The reasons for this will be discussed later in the chapter. The hay entering the Florida market is channelled through four main hay dealers. These hay dealers are able to control the quality and the price of the hay because of their large network of suppliers.

With either a monopoly or an oligopoly, information is still required about the quality characteristics of the product. A seller to a monopsony requires the quality characteristics of his product to equal that demanded by the buyer, just to sell the product. In an oligopoly, the buyer needs to know the quality of the product sold by the sellers, to ensure it matches the requirements of his business. Information about the quality of the product is not always easily decipherable, or available.

Asymmetric information about the quality of a product leads to uncertainty on the part of the buyer. When the quality of a product cannot be verified by an objective test or a third party, a difficult situation arises for the buyer, because he is unsure of the quality of the product being received (Phlips,

1988). Laffont and Maskin (1987) argue that the most profitable approach for the producer or seller is not to reveal the quality of the product, if they are in a monopoly position. As a result, the buyer should be very leery of non-tested products, particularly from a hay dealer holding a very large percentage of the market.[4]

Adverse selection is present in most hay markets. Poor quality hay has the potential to drive premium hay out of the market place. Akerlof (1970) illustrates how, if more bad products enter the market, the price received in the market will decrease. A seller of a good used product would be less willing to enter his product in the market because he would receive less than a fair price for his product. The result is that bad products push the good products out of the market. Adverse selection can occur in any markets in which one participant involved in a trade has more information than the other participant.

When the farm manager purchases hay, he views the market in a similar fashion. He believes that unless the product is guaranteed, it is of lesser quality. For the buyer to be interested in a load of hay that is not guaranteed through a hay dealer, the buyer would have to visually inspect each bale of hay before purchasing, and receive a price discount on the load.

Phlips (1988) counters that if more information were given to the trader who lacks information, the quality of product available would increase. This

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[4] Hay dealers in the Florida hay markets require the hay to come with a chemical analysis before receiving the shipment, while very few of the hay dealers pass the results of the quality tests on to the farm managers.

would take place because sellers must compete for market share, and would need to offer a more desirable product than other sellers. By offering information concerning quality to the hay buyers at the farm level, it would be possible to receive more of the market share. The hay buyers would be in a better position to follow the market trends and get the type of product that they actually desire.

Although it is possible for the buyer to take advantage of the seller, the opposite is more common. An example of the buyer taking advantage of the seller may occur in the case where the seller must ship the product a large distance. When the product arrives at the buyer's location, agreement cannot be reached on the quality of the product. The seller is not in a position to make an alternate transaction in another location because the cost of transporting the product to another buyer may be more costly than selling at the discounted price. This scenario may arise when producers sell hay to hay dealers in distant markets such as Japan.

Hay dealers do not view this as a problem because it is part of doing business, but they want to maintain a good image and reputation with the hay buyers. The hay dealers have several ways to work around the perceived problems of quality. A common approach used for manufactured goods is to offer a product warranty (Phlips, 1988). A warranty is a quality signal because the seller would be unwilling to warrant a product that is not of sufficient quality. The additional costs of supplying a warranty adds pressure to the

seller to ensure the product is of good quality, and that the warranty would be used seldomly. Problems exist with using a warranty with hay, because it is difficult to determine problems with feed after it is ingested by a horse.

The other approach is to offer a system of outlining the quality of the hay, and guaranteeing the quality. The reputable hay dealers offer consumers a guarantee indicating that the dealer will replace any hay that is not acceptable to the purchaser free of charge. This guarantee typically only covers hay returned to the hay dealer.

A grading system for the hay could solve several information problems associated with these markets. The hay buyers on the farm can purchase the quality of hay they desire without having to travel to the seller's warehouse for a physical inspection. The hay dealers would not have to send their hay buyers to the source of the hay to ensure its quality. And finally, the hay producers would have a better understanding of the needs of the hay buyers at the farm level.

3.2 Grading Systems

The need for reliable grading systems was stated in the 1930's by United States government officials.

> "Grading has been promoted by producers and traders, and largely because they stood to gain by it; but grades must rest solidly on consumers' preferences or on basic utility to consumers if they are to be effective ... the fundamental economic justification of grades ... is that they afford a means for consumers to register their preferences more accurately ... so that ... consumers are better

> able to encourage the production of the grades they prefer and to discourage production of the less desirable grades"(Kohls and Uhl, 1980, page 359)

Government agencies typically establish grading programs to enable markets to function more efficiently, to remove uncertainties inherent in exchange, and generally to make markets operate in a similar manner to the classical competitive model (Helmberger et al., 1981).

In earlier years, the definition of grading did not include any reference to the consumers, but strictly the availability of the product. Grading has been defined as "... a process of segmenting a highly heterogeneous supply of a commodity into smaller, more homogeneous groupings which are more nearly substitutable for one another than with other units" (William and Stout, 1964, p 467).

Current grading can be defined as the "segregation of heterogeneous material into a series of grades reflecting different quality characteristics of significance to users" (Canada Grains Council, 1982). This definition implies that a grading system must benefit users in order for it to be accepted.

The meat industry uses a consumer oriented grading system. Amendments to the Beef Carcass Grading Regulations resulted in significant changes to beef grading. The most significant change occurred with the addition of marbling and yield criteria at the request of the food service industries. Marbling is believed to be an important factor indicating taste quality (Gietz, 1991). The modifications to the grading system resulted in more

of a consumer orientation than was the case for the previous grading system.

3.2.1 Benefits and Costs of Grading Systems

Grading systems benefit both consumers and producers. The grading system allows for easy distinguishability between the low and high quality products. The producer is given information about the quality of his product compared to other products, and the attributes of his product that must be improved to obtain higher prices. The consumer is able to discern quality more easily and decide whether the price difference is worth the extra cost of the higher quality product. Finally, consumers and producers share the gains from the reduction in marketing and transaction costs.

The benefits of a grading system occur in the form of increased social gains and efficient allocation of resources (Helmberger et. al. 1981). Williams and Stout (1964) describe the theoretical gains obtainable from grading through the use of supply and demand models, as well as indifference and substitution models. "Net economic gain can be defined as the difference between the economic usefulness or value of a grading system to society, ... and costs" (William and Stout, 1964, page 478). They go on to suggest that the usefulness of the grading system can be assured by basing the grades on quality attributes that are important to consumers.

A grading system is required if one or more quality attributes exist that are important in terms of subjective value to consumers and variations in these

attributes cannot easily be determined accurately by the buyers at the time of purchase. An example of an attribute that is not easy to determine would be the chemical analysis of a product. Although consumers do not have to agree on the degree on importance of the attributes, it is necessary that the consumers consider these attributes for acceptance or rejection of the product.

It is economical to implement a grading system if the attributes of the product are sufficiently important to consumers in terms of significant differences in prices they are willing to pay. The need for a grading system must also exist for a grading system to be economical. It is not necessary that buyers agree as to either relative importance of attributes or premiums and discounts. A requirement is that consumers are willing to pay significantly different amounts depending on specific attributes and attribute levels. The grading system should provide sufficient incentive to the producers to produce the top quality grade. If the grading system does not provide the necessary incentive, the grading system is not required, or is not the correct system to follow.

The need for grading systems is much more predominant in agricultural production than the manufacturing sector, because of the degree in variability of quality for agricultural products (Rhodes, 1983). Manufacturers have better ability to control production to ensure that their output matches consistent quality specifications. The agricultural sector is dependent on the weather, the ability of farm managers to complete tasks in a timely manner, pest damage

and a multitude of other factors affecting the growth of the product.

The production of high quality products is not without extra costs. Better production practices are required on the part of the producer, as well as more time and money. The production of high quality products is not always economical. In some cases, the extra costs of production is greater than the higher price the market is willing to pay.

"One of the problems...is that the consumer knows relatively little about the quality of the goods..."(Kohls and Uhl, 1980, page 375). Although this is not true for all commodity markets, it appears to be correct for the Florida market for horse hay. Not all consumers understand the benefits of purchasing high quality products. Horse owners in Florida do not fully appreciate the advantage of alfalfa hay for their animals. Some view alfalfa hay as a fibre feed with little nutritional value, while others believe that alfalfa contains too much protein.

The buyer benefits from the grading system by knowing the quality standards of the grade purchased. The presence of a grading system simplifies the transaction, because the buyer does not have to inspect the product before purchasing, and the seller has an idea of a fair market price for the product.

Grading systems do have disadvantages. Not all sellers gain from the use of grading systems. The producer selling a product that is of lesser quality, or of a lower grade loses business to the producer who is selling a top quality product. For consumers to receive the full benefit of a grading system, it is

necessary for all producers to sell on the basis of the grading system (Kohls and Uhl, 1980).

The other potential loser is the dealer or trader. Traders can increase their profit ratios by not indicating the quality of the hay to the buyer. The dealer basically acts as a discriminating monopolist. The dealer charges each consumer as if they were receiving the high quality product, when the consumer does not need or receive the high level of quality.

The important consideration in the development of a grading system is to find a set of characteristics that is acceptable to all players. Consumers would prefer a grading system with very tight standards to ensure the product is exactly what they want. Producers want grading systems that are more lenient so they can consistently produce a product in the highest grade. Some unscrupulous dealers or other middleman would prefer that grading systems did not exist because it has the potential to reduce their profits. Most grading systems are based on what can be easily produced and in large enough quantities to provide sufficient supply of all grades. However, producers have an interest in consumer based graded systems because of the potential extra revenue from supplying the exact needs of the consumer.

3.2.2 Agricultural Grading Systems

Grading systems are used frequently in the agricultural sector because of the variable nature of quality of production. Agricultural commodities for

which grading systems exist include cereal grains, fruits and vegetables, eggs, milk and dairy products, and meats such as pork, poultry and lamb. Until recently, very few of these used grading systems that rank the attributes of an agricultural product with respect to the preferences of the buyers. For the most part agricultural products are traded in commodity markets and grading systems have been based on quality differences that are easily distinguishable.

Some measures of quality do not include all the relevant information required to determine the value of the product. For example, the chemical analysis of hay does not make any reference to colour, stem size, or palatability of the hay. The horse owner may be concerned with the chemical analysis of the hay, but is often more interested in its colour and palatability. This implies that chemical analyses are not very useful to the consumer and as a result few horse owners rely on this quality indicator to purchase their hay.

Grading systems are designed to improve the marketing mechanism of products. Agricultural products use grading systems because of their diverse range of characteristics. The products are sorted by their quality characteristics such as shape, size, colour, etc. into grades. "The relevant grading and sorting criteria are either determined formally by public authorities according to behavioral patterns of buyers and sellers, or institutionalized through formal, or informal, arrangements within trade channels" (Zusman, 1967, page 89). As international trade increases, problems are arising with grading systems because of the lack of uniformity between trading regions. This causes a

reduction in market performance, in terms of transaction times and quality definitions, as well as missed opportunities for traders.

The need to report information that more exactly matches the desires of consumers has been increasing. This is illustrated in the grain trade by the introduction of protein-grading of wheat. Traditionally, grain buyers would acquire grain from selected areas on their reputation for protein content. As the ability to easily determine protein levels has become available, the industry has further segregated and offered grain with guaranteed minimum protein levels.

Consumer preference for a product is based on the many attributes of the product. The consumer's perceived quality belief of a product is a subjective property measuring the desirability of a product. Conversely, a proper grading system is not subjective, and relies on defined units of measure.

3.3 Comparison to Optimal Grading Systems

Helmberger et. al (1981) outlined the optimal grading system as follows:

1) Optimal grade standards should allow the consumers to relay information to the producers about their needs and desires of the product.

2) The grading system should improve the economic gains from grading, in others words, the need for a grading must exist.

3) The standards separate units of the commodity into groups such that for each grade within-grade variation in quality attributes relative to the variation between the grade and each of the two

possible adjacent grades has been minimized. The standards also should maximize differences among grades in the range of quality attributes, which means that overlapping has been reduced to a minimum.

4) Standards should be built on factors and terminology that will make the grades meaningful to as many users as possible, as well, the grading technology would be used at all levels from the consumer to the producer.

5) The factors of the standards should be accurate and uniformly measured and easily interpreted.

6) The grading system must be simply and easily understood, it should also be fixed in the short run, but subject to change due to longer-term considerations.

7) The cost of the grading system must be economically feasible.

A comparison between the Canadian Hay and Straw Inspection Act of 1927 and the optimal grading system criteria outlined by Helmberger et al is summarized below. The Hay and Straw Inspection Act was chosen for the comparison because it was the last federal hay grading system to be utilized.

A grading system should allow consumers to express their needs to the producers. This is not evident with the Hay and Straw Act of 1927. The act was based on the products that could be produced by the sellers. This is demonstrated by the existence of different standards between eastern and western Canada, based solely on types of hay grown in the regions and the different types of grades within the grading systems.

The second criterion for an optimal grading system is that it should create economic gains. This is difficult to determine because hay prices are not

available from 1927. Based on discussions in the House of Commons, however, there appeared to be economic gains to the hay producers and possibly the hay traders.

The third criterion is that the variation of quality within a grade should be minimal and that the differences between the grades should be maximized. The quality variation within the grades of the 1927 Act were very high. This is because the grades were based on the percentage of a grass or legume and for the most part did not specify what the other percentage had to be. For example, *No. 3 Timothy Hay* and *No. 1 Timothy Clover Mixed Hay* could be the same bundle of hay.

The fourth criterion, that the terminology be understood by most of the users, does not appear to have been a problem. People working with hay would not have trouble understanding the grades outlined in the 1927 Hay and Straw Inspection Act. Therefore, this criterion was met.

The fifth criterion is that the attributes should be accurately and uniformly measured. This is debatable because the inspectors were working with "visual" percentages that could vary considerably among the group. Although the inspectors were trained to grade the hay, the deputy inspectors were taught by the inspectors in their area. It is quite unlikely that uniformity would hold across two or more inspection areas.

The sixth criterion suggests that the grading system should be fixed in the short run, but subject to change given long term considerations. This

appears to be the case for the most part. As problems arose with the grading system, parliament was open to changes providing there was an established need.

The final criterion is that the cost of the grading system must be economically feasible. The estimated cost of the inspectors was between $1000 to $2000 per day, resulting in an annual cost of approximately $365,000 to $730,000 (Bennett, 1928) Producers were charged 20 cents per ton to have their hay inspected. It is difficult to comment on the economic feasibility because the change in hay prices caused by the grading system is not known. The question of whether the revenues from the inspections covered the government expenditure is not known, but simple arithmetic suggests they would need to grade as much as 3.65 million tons to break even.

The 1927 hay grading system did not meet several of the criteria for the optimal grading system. This may explain why it is no longer in use by sellers, buyers or traders.

The provincial hay certificate programs can also be assessed according to Helmberger's model for the optimal grading system. The hay certificate programs do not have maximum grade standards, however, so it is difficult for the consumers to relay information to the producers about their expectations of quality. For the producer to gain information about consumer needs, he must track all sales and keep records of the hay quality in each sale. This is significantly more time consuming than knowing what grade of hay sells the

best.

The second criterion indicates there should be economic gains through the system's usage. It is difficult to comment on this because the certificate programs are new to the industry. There is significant pressure from forage councils and government agencies to get buyers to ask for certified hay. This would result in more sales and possibly greater profits for sellers who use the certification over those who do not.

Since the certificate programs do not group the hay quality characteristics into grades, the third criterion is not met. This is particularly important for trade in markets that demand large quantities of hay in a single shipment. Typically, it is not possible for a single producer to supply very large customers, and a method to bundle the hay of several producers is required.

The fourth and fifth criteria state that the terminology be easily understood and accurately measured. The terminology used in the hay certification program is known to the users of the system. Some trouble could arise with the more arbitrary definitions of characteristics such as odour, stem size, texture etc. The levels of odour are described as fresh, dull, and musty, all of which are subjective.

The sixth criterion states that the system should be easy to follow, as well as fixed in the short run and flexible in the long run. The hay certificate program lists out all attributes of the hay including where it was grown. This makes for a complicated, but complete, information transfer. With respect to

the mechanism to modify the system it should be relatively easy considering the provincial forage councils currently operate the certificate systems.

The last criterion requires that the system is economical to operate. The fee charged for having hay certified is $70 per lot. This covers the cost of sending an inspector to the farm to examine the hay, and the lab fees for the chemical analysis. Other than the initial start up funds required by the forage councils, the government is not funding the program. Given the self supporting nature of the certificate program, its continued operation would suggest that it is economical.

Although Helmberger's optimal grading system deals with most of the criteria for a grading system, one important aspect was left out, that of "responsibility". With federally regulated grading systems, the government is responsible for the grading systems. The hay certificate program is not operated by any level of government, and therefore the government is not willing to be responsible for it. The forage councils do not offer any mechanism for complaints about the use of the certificate program. In short, the hay certificate program offers no guarantee that the information provided is correct. This is not acceptable for either export or domestic markets.

It is clear that the current trends for hay grading do not measure up to the optimal grading system outlined by Helmberger (1981). The need for a grading system that allows products to be grouped in bundles increases as customers place large orders that cannot be handled by single producers. The

new grading system should meet the criteria of Helmberger (1981) and have the protection of a stable environment within which to operate.

The next chapter outlines the theoretical framework for the development of a consumer oriented grading system. This type of grading system should allow producers and consumers to benefit from its usage, because it defines the needs and wants of the end users.

4.0 THEORETICAL FRAMEWORK

The development of a grading system involves compromises. A balance must be struck between what is optimal, or "best", in terms of distinct quality separations and what can be supplied by the industry from a practical point of view. Above all else, however, grading systems should be based on characteristics that are meaningful to the users. For this reason, the starting point of the grading system is consumer theory.

4.1 Consumer Theory

The basic hypothesis of consumer theory "is that the rational consumer will always choose a most preferred bundle from the set of feasible alternatives" (Varian, 1984, page 115). For example, the hay buyer receives utility from the hay purchased, and not from the attributes of the hay such as the protein content or leaf attachment. If this approach is taken, it is difficult to translate the utility received into a grading system, because there is no way to separate the characteristics of the product. A theory is required that allows the use of the individual attributes.

Lancaster's approach to consumer utility theory allows the characteristics of a product to be separated. "Utility or preference orderings are assumed to rank collections of characteristics and only to rank collections of goods indirectly through the characteristics that they possess" (Lancaster, 1991,

p12). Lancaster's statement suggests that ranking of the goods is based on the different characteristics contained within each good. This is an important concept in the formulation of a grading system.

Grading systems are based on different levels of characteristics in a product. In the past, this has not been directly linked to consumers' utility functions. Consumers have utility functions for each characteristic in a product. These utility functions are combined to form the utility function for the product. A grading system that uses the utility functions for the individual characteristics would more likely represent consumers' preferences.

4.2 Stated Preferences

"Modern economic choice theory starts from the assumption that individuals...have market behaviour generated by maximization of preferences" (McFadden, 1986, page 278). Stated preference techniques are used in business marketing to determine the consumer appeal of certain product attributes. For example, consumer taste tests are used in manufactured product design to help develop products with the desired level of attributes. There are no previous references in the literature to the use of stated preferences for the development of grading systems. This is not surprising, however, given the lack of empirical research that has been carried out to link consumer preferences to an appropriate grading system (Helmberger et. al., 1981).

Consumer preferences, which have been studied extensively in the marketing of brand name goods, could be used to determine the appeal of agricultural commodities. In hay markets, each horse owner has an opinion on the perfect bundle of hay. Consumers are willing to pay more for a product that meets all of their requirements than for products that do not. This is the main assumption required for consumer based marketing. Marketing agents attempt to determine the attribute levels that consumers view positively and incorporate these features into the product design.

Consumer preferences can be broken down into utility curves for each attribute of the product (Green and Wind, 1975). This assumes that preference for each attribute is independent of the other attributes. The attributes of the product are the different characteristics of the product. For example, the attributes of hay are colour, protein levels, stem size, texture, etc. The consumer's utility curves for the attributes are derived from the different levels of the attribute. A theoretical method that would modify a form of consumer utility functions into to a grading system has been proposed by Zusman (1967).

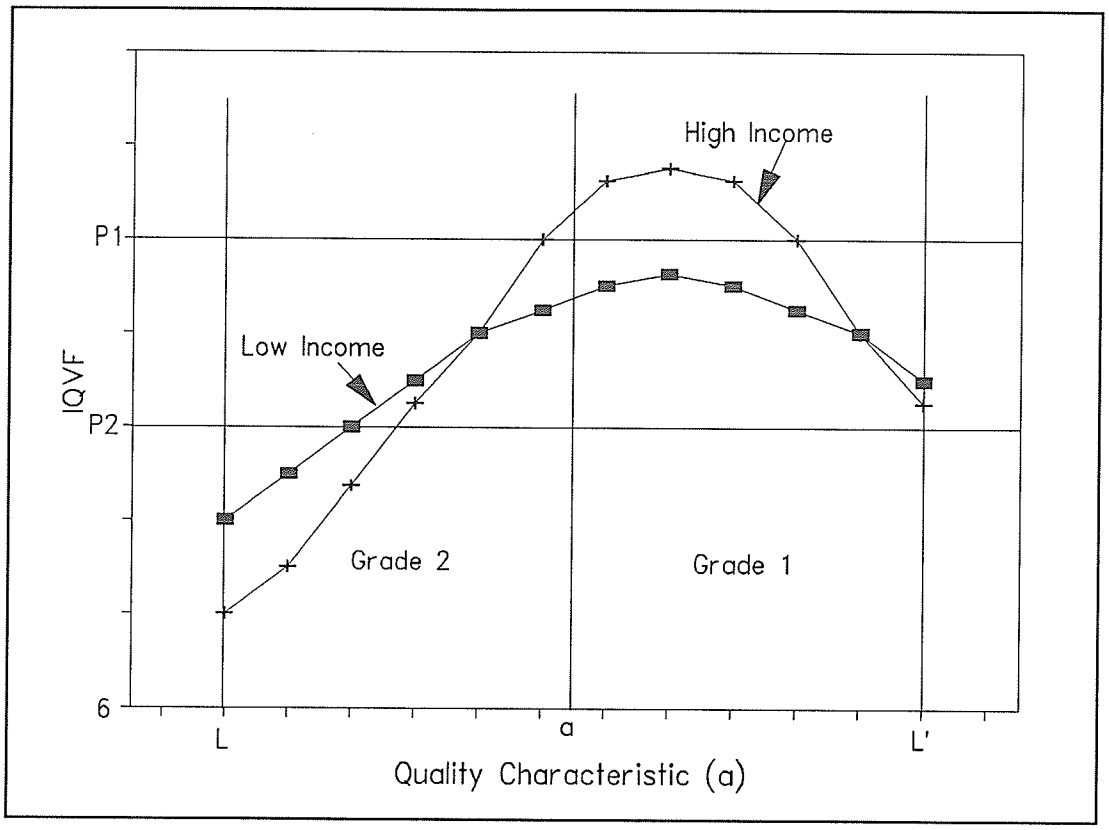
4.3 Zusman's Grading Scheme

Zusman (1967) outlines a theoretical model for the determination of a grading system that is based on the requirements of the consumers. Zusman combines the individual's income and preferences for a certain quality level of an attribute and compares these to the price of that particular quality level to

form an individual quality valuation function (IQVF). Consumers' IQVFs are combined to developed the grading scheme.

Zusman suggests that an IQVF curve exists for every attribute of a product. The IQVF is the value of the composite commodity with an additional unit of product with quality characteristics $a_1,\ldots,a_n$. The composite commodity represents all other commodities purchased by the individual. The IQVF curve is derived from the marginal rate of substitution between the change in price and a shift in the quality level of the attribute, assuming a fixed income. Figure 4.1 demonstrates the IQVF curve for one individual and one attribute. A change in income of the individual shifts the IQVF curve. Zusman assumed that an increase in income would result in a sharpened quality preference.

Figure 4.1 Individual Quality Valuation Functions



P1 is the price for the commodity of quality level grade 1, while P2 represents the price for a grade 2 commodity. If the individual had a low income, a grade 2 commodity would be purchased, because the area under the price P1 for grade 1 is larger than the area under the IQVF curve. The IQVF curve for an individual indicates the value the individual places on the quality characteristic (a). The area under the curve represents the average price the individual is willing to spend on the characteristic, if this area is less than the area of the price of the characteristic level, the individual would settle on a lower quality product.

Each individual has a unique IQVF curve that is dependent upon their

beliefs of quality and their income. The IQVF curves also take into consideration the market prices of the commodities at different levels of quality. One end of the IQVF curve (L) measures the value for the lower bound of the quality characteristic, while the other end (L') represents the upper bound. The IQVF curves are increasing during the approach to the preferred level of quality characteristics and decreasing when moving away from the preferred level.

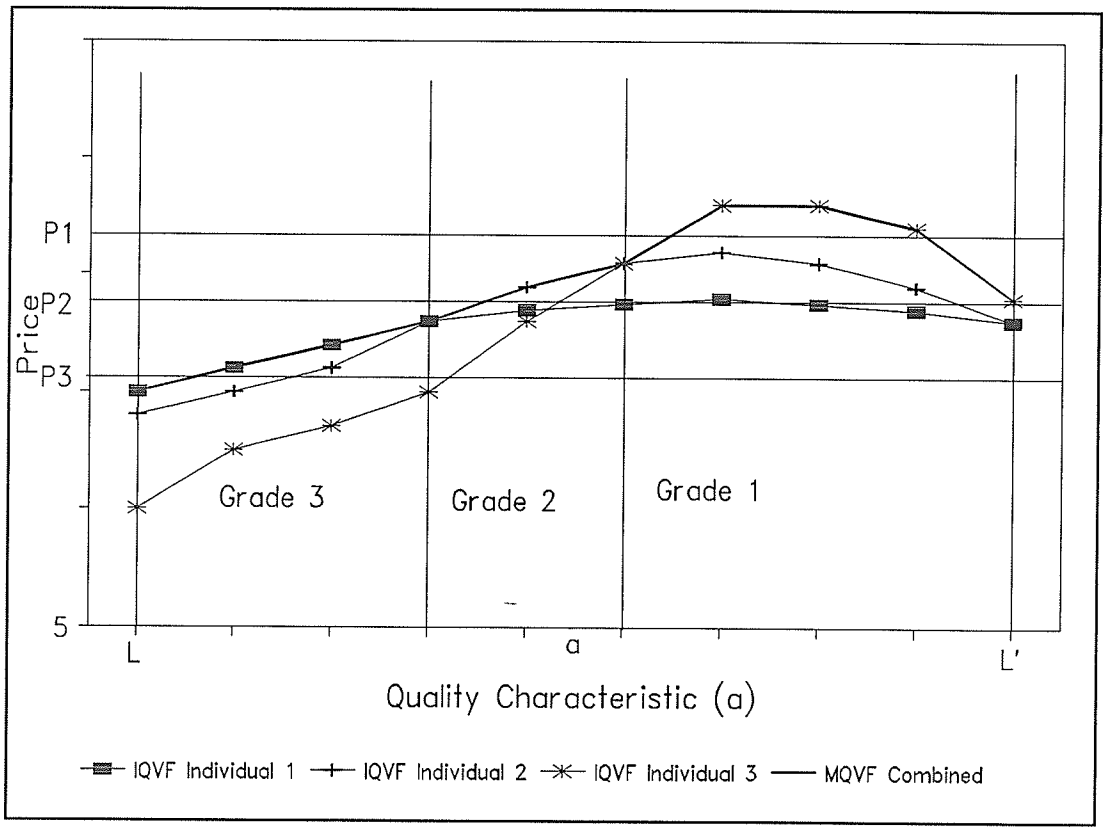
By combining the IQVF's of all participants in the market, a market quality valuation function (MQVF) is formed for the particular attribute. Figure 4.2 shows three individual IQVF curves, plus the MQVF curve, which is a combination of the IQVF curves. The MQVF curve is derived from the highest price any of the individuals are willing to pay for a particular level of quality characteristic (a).

The optimal number of grades in the system and the attribute levels of each grade is determined by forming a MQVF curve from the IQVF curves of several attributes, and individual IQVF curves. The optimal number of separate grades is determined by the number of intersections of the IQVF curves used to make up the MQVF curve. Put another way, a grade separation should occur at every point an individual's IQVF curve is higher than the previous point on the MQVF curve, which was from another individual. This approach is similar to a discriminating monopolist, in that it has a grade for each individual whose IQVF curve is part of the MVQF curve.

The level of attributes contained within each grade is also determined by

the grade separation. In Figure 4.2, the IQVF curves intersect each other three times, which theoretically implies three grades are required for the optimal grading system. This assumes a zero cost of implementing the grading system. When these costs are taken into consideration, the efficient number of separating grades decreases. Figure 4.2 shows the optimal three grades, but does not consider the extra costs.

Figure 4.2 The Market Quality Valuation Function



Zusman's model is based on consumer demand, which is determined by their utility curves for the different attributes of the product. This process is ideal for products used ultimately by consumers where the levels of attributes

are known, as are the consumer's preferences and the consumer's income. When the desired level of attributes and income of the individuals are not known, it is difficult to use Zusman's model.

The basic theory of Zusman, that the consumers' utility for product attributes can be used to form grade separations and attribute levels, is critical for the next step in the development of a grading system based on stated preferences. Zusman also assumes that information about consumers' preferences are available in a nearly continuous function.

5.0 CONJOINT MEASUREMENT GRADES

Zusman (1967) theorized that a grading scheme could be developed around consumer utility functions. A method that can be used to determine consumer utility of attribute levels for a product is conjoint analysis. This chapter illustrates how the results of the conjoint analysis can be transformed into the characteristics of a grading system. The chapter concludes with a discussion of the survey used to retrieve information from the consumers.

5.1 Conjoint Analysis

Conjoint Analysis (CA) is a quantitative method used in market analysis to determine the wants and desires of consumers. CA has been employed primarily to determine the quality attributes of manufactured goods that consumers view to be most important. Green and Srinivasan (1990) estimate that CA is used over 400 times per year in commercial applications. Other disciplines have been slow to adopt the CA method. In agriculture, CA has been utilized to determine consumer preference for farm raised striped bass (Halbrendt et al, 1991). This is the first time, however, that CA has been implemented in empirical agricultural research.

Conjoint analysis was developed in field of marketing from a foundation

in psychometrics.[5] Laboratory data on preferences of individuals in simulated market settings, as well as data concerning attribute scaling and importance, are incorporated to determine qualitative rankings of attributes (McFadden, 1986).

There are six steps in the determination of a CA model: selection of a model; data collection; survey design; survey presentation; measurement scale for the dependent variable; and finally estimation method (Green and Srinivasan, 1978). The selection of the model is dependent on the type of results required. This thesis uses the part-worth function model because it provides the greatest flexibility in allowing for different shapes for the preference function (Green and Srinivasan, 1978). The part-worth utilities are the values, as viewed by the respondents, of the different levels of the attributes being tested.

A pre-test survey was conducted with ten respondents to determine which attributes should be included in the conjoint analysis. The pre-testing involved quizzing the respondents about which attributes are most important to them. The format of the pre-test survey is outlined in section 3 of Appendix C. This section was repeated in the main survey to ensure the results were reliable. The attributes included in the conjoint analysis were the three highest rated variables.

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[5] The field of psychometrics is based on the measurement of subjective perceptions of physical reality (Louviere, 1988).

Four variables were chosen for use in the model: leaf attachment, protein level, colour, and price. Leaf attachment and colour were used because preliminary research indicated that they are very important to horse owners. Appendix E discusses other studies conducted on the consumers preferences for hay. Protein is included in the analysis because it appears to becoming more important to the horse owners in the determination of rations.[6] Price was included because it shapes all consumption expenditures.

Three levels of each attribute were tested. Other than the levels for price, the attribute descriptions were taken directly from the Manitoba hay certification program. This allows the results of the CA grading system to be mated easily with the established program. The price levels were derived from preliminary research in the Florida horse markets.

Leaf attachment levels consisted of greater than 90 percent attachment, between 90 and 75 percent, and the last level at 75 to 50 percent attachment. The three colours used were bright green, dark green and light green. The protein levels included greater than 20 percent crude protein, between 20 and 18 percent protein, and between 18 and 15 percent crude protein. The three prices were $250/ton, $220/ton and $190/ton. These prices are based on the high, average and low prices charged for alfalfa hay in Florida by hay dealers.

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[6] There is a large movement in the horse industry to use feed rations with high protein levels. In the past owners were concerned that colts have growth problems when fed pure alfalfa, but recent research has indicated the problem was mineral imbalances.(interview with Barry Long, farm manager of Hidden Point Farms, April 1992)

An example of the conjoint analysis part-worth function model for this study is as follows:

$$Uj = C + V(S1j) + V(S2j) + \ldots + V(Snj)$$

where Uj represents the unknown and unobservable utility of bundle j, C represents the additive constant, which is required to set a zero point on the internal scale, and V(S1j) - V(Snj) are the part-worth utilities of the j bundle (Louviere, 1988). By replacing the unobservable utility with the consumers evaluations R_j, the equation becomes:

$$R_j = C + \beta_1 (LA1_j) + \beta_2 (LA2_j) + \beta_3 (LA3_j) + \beta_4 (C1_j) + \beta_5 (C2_j) + \beta_6 (C3_j)$$
$$+ \beta_7 (CP1_j) + \beta_8 (CP2_j) + \beta_9 (CP3_j) + \beta_{10} (P1_j) + \beta_{11} (P2_j) + \beta_{12} (P3_j) + e_j$$

where R_j represents the ratings of each bundle j outlined in the surveys, C represents the additive constant, which is required to set a zero point on the internal scale, β_1 - β_{12} are the part-worth utilities (beta coefficients of the regression) of bundle j, and e_j represents the error term. LA1 - LA3, C1 - C3, CP1 - CP3, and P1 - P3 represent the levels of leaf attachment, color, crude protein and price respectively. Only one level of an attribute can exist in the equation at a given time, therefore a dummy variable approach was used. From the bundle ratings, the part-worth utilities are determined for the attribute being analyzed. The ratings (Rj) are proxies of the overall utility associated with each bundle. It is from here that the part-worth utilities of the attribute levels (V's) are derived. This approach is based on the maximization of an additive utility function, which assumes that consumption of one attribute does not affect the

consumption of another attribute (i.e. the attributes are independent of each other) and that preferences for each attribute are independent. The maximum utility is obtained when the highest part-worth utilities from each attribute are sumed together. Put another way, when the most preferred level of leaf attachment is combined with the most preferred level of color, crude protein and price, the maximum utility is reached.

The conjoint analysis has been used primarily in the marketing field, where including price in the utility function is not considered a problem. Price can be described as an attribute of a product, and the conjoint analysis ranks the important attributes. In the field of economics, however, price is not typically included in a utility function because it is a variable of the budget constraint.

To avoid this conflict, an indirect utility function can be used to measure the utility instead of a direct utility function. The indirect utility function is the maximium utility achievable given price and income. The indirect utility function is conditional on quality attribute levels. Therefore the additive function is now based on price and the other attributes. This does not affect the analysis, because the purpose is to determine which attributes are important to the respondents of the test.

Data collection for this study is based on the full profile model. The full profile approach lists a level from each of the attributes being tested to form a "complete product" (Halbrendt et al, 1991). In other words, every attribute

of the product is tested in each bundle. The profile model gives the respondent a better description of the product being rated than the "Two-Factor-at-a-Time" profile approach.[7] The disadvantage of the full profile approach is the potential information over-load problem that can result if too many attributes are tested simultaneously.

The full profile method suggests that each characteristic should be tested with each of the other characteristics. For example, if there are three characteristics being tested and each has three levels of quality, 27 bundles should be rated or ranked to get a complete understanding of the results. In this study there are 4 attributes, each with 3 levels. This works out to 81 bundles, or 81 questions to ask each respondent. Many respondents would have a difficult time trying to answer 81 questions without losing interest in the survey. This would lead to inaccurate results, as well as being very time consuming. The "over-load" problem can be avoided by using a fractional factorial design to reduce the number of questions each respondent must answer (Green and Wind, 1975).

Fractional factorial survey designs are determined using orthogonal codes to reduce the number attribute bundles, but still extract the required information about the main effects. The use of orthogonal codes assume that the matrix does not have any multicollinearity between the attributes, and therefore any

[7] The two factor at a time profile approach requires the respondent to compare the levels of two attributes, while ignoring the remaining attributes.

interactions on either side of the orthogonal array are negligible (Green and Wind, 1975). The orthogonal codes are multiplied by the columns that represent each attribute to transform the input matrix (Louviere, 1988). This effectively reduces the number of bundles that must be rated to determine the main effects of the attributes. The orthogonal codes used to manipulate the columns of attributes vary depending on the number of attributes and the level of each attribute. These codes are available in design catalogs such as McLean and Anderson (1984), and Hahn and Shapiro (1966).

For this study, the Bretton-Clark's Conjoint Designer package was used to determine the quality bundles. The Bretton-Clark Conjoint Designer uses the orthogonal code method to reduce the full factorial design to a fractional factorial design. For a more complete discussion of the orthogonal design of the fractional factorial refer to Geramita and Seberry (1979). The limitation of this approach is that only the part worth utilities of the attributes can be determined and not the possible interaction effects that can occur between the attributes. Full factorial survey designs can isolate the interaction between attributes, as well as determining the part-worth utilities. The effects of using the fractional factorial design are not detrimental to this study because the CA is used only to rank the attributes, and the assumption of statistical independence between the attributes is in place.

The observable utility of consumers (Rj) can be gathered in the form of rankings, ratings, or comparisons. Given equal questions, ratings and rankings

provide more information on preferences than do choices (McFadden, 1986). The risk of obtaining inaccurate data is higher using a choice method because of the potential biases of individuals in making probability judgements. The rating method does not require the consumer to remember all bundles, and for this reason it is chosen to relay the information.

Consumers are asked to rank or rate quality characteristics bundles of a product. Each bundle contains a different grouping of quality characteristics. These bundles are compared to several different bundles to determine which is most attractive to the test individual. The most attractive bundle receives the highest rating and the remaining bundles are given ratings based on their comparisons to the highest rated bundle.

To analyze a product using the conjoint method, the researcher must determine what attributes are to be tested, and the number of levels for each attribute. Utility functions are determined for each attribute being tested, based on the number of levels of attributes in the product (Green and Wind, 1975). This is the main difference between the CA method and Zusman's grading scheme. Zusman's method determined the levels of each attribute in each of the grade separations.

Several methods can be used to calculate the "part-worths" of each attribute and the quality levels. MONANOVA, LOGIT and regression analysis have commonly been used to calculate the part-worths. Cattin and Wittink (1981) suggest that regression analysis performs well on external validity. This

implies that the results of the CA accurately portray the actual preferences of the individuals questioned. The rating for each bundle represents the dependent variable of the regression analysis, while attribute levels are the independent variables.

Part-worths can be described as the value that an individual places on each level of an attribute. For example, a large package size might be considered more desirable by an individual than a smaller sized package of the same product. In this case, the part-worth for larger package size would be higher than the part-worth of smaller sized packaging of the product.

The CA determines the order of importance of different attributes based on the preferences of the consumers. The range of the part-worths within a given attribute represent the importance of that attribute compared to the other attributes being tested (Green and Srinivasan, 1978). The range is calculated by adding the absolute values of the high and low "part-worths" of the attribute. The range of each attribute is divided by the summed ranges of all the attributes to determine a percentage measure of importance for the given attribute. This results in an ordinal ranking of the attributes. The exact percentages carry little meaning because the conjoint analysis does not create cardinal measures.

Jones (1990) used conjoint analysis to determine consumer preferences for campground design features and price. This study was used to determine if the service provided by provincial campgrounds met the demands of the

consumers and to determine what attributes were deemed important by the users. The data used for this study came from known users of campgrounds. The data was collected through the use of surveys that were distributed in campgrounds.

The results of the study indicated that price was the most important attribute in determining the campground used by consumers. The provision of showers, beaches, and fishing opportunities all proved to have a positive effect on the use of campgrounds. Hiking trails, camp site reservations systems, and stores had little effect in determining the campground choice. Negative effects on campground decisions came from having to purchase firewood on a per day basis, as opposed to having firewood included in the price of the campground.

5.2 Survey

The survey of hay buyer preferences was conducted with 50 horse farm owners in the mid region of Florida. The respondents came from the *Florida Horse*, an annual publication that lists all horse farms in the state. A random systematic sampling method was used to produce a non-biased sample. The random systematic sampling method consisted of taking the list of 350 horse farms and contacting every third farm. Of the 115 individuals, wrong numbers and individuals not interested in responding to the survey reduced the number of useable surveys to 50. This resulted in 450 observations for the CA, because each respondent provides answers to nine questions.

There are four sections to the survey. The first section is used to determine the size and the type of farm, as well as its feeding requirements. This section serves as a screening mechanism to ensure that the respondent fits into the group being tested. The first section of the survey was also designed to be easy to answer and to keep the interest of the respondent.

The second part of the survey was designed to collect data for the conjoint analysis. The choice of attributes to be tested by the conjoint analysis was limited to variables that were assumed to be independent of each other because of the additive utility function and the use of the fractional factorial design. The violation of this assumption should not have a large effect on the results of the survey, because only the part-worths are required for this study.

The third section of the survey asks each respondent to rate the importance of a list of product attributes. Section three was set up to serve as a check, and to determine how variables not included in the conjoint analysis were perceived. All variables pertaining to the quality and desirability of the hay were included to discover as much as possible about the characteristics of the desired hay.

Some variables were omitted from section three because of the dependence on variables already incorporated. Texture was not included because it is tied very closely to stem size as well as leaf attachment. This is an example of a "non-independent" variable. It was felt that the information not collected by omitting texture was insignificant because leaf attachment was

included in the test and that texture was not viewed as important.

The final section of the survey was used to gather information on the size of the hay market, in terms of the volumes and the price of alfalfa purchased by the establishment. The questions regarding current buying practices were also used to check whether the level of prices chosen for the CA were reasonable. A copy of the survey form is presented in Appendix C. A tabular summary of the survey results are presented in Appendix F. General information on the Florida hay market for horses is presented in Appendix E. The balance of this thesis focuses on the development of a grading system for hay.

5.3 Conjoint Analysis to Grades

The survey results from the CA part-worth model are regressed to yield coefficients for all levels of each attribute. To avoid the dummy variable trap[8], one level from each attribute is left out of the regression and assumed to be zero. These coefficients represent the utility level of each level of attributes, as viewed by the respondents. The attributes with the higher ranges can be used as the basis for the establishment of a grading system, because they indicate what the consumers view as important product characteristics. The coefficients for the levels within the attribute range indicate the importance of

[8] The attribute levels are listed in the regression using dummy variables. By including all of the attribute levels in the regression, a singular is formed and results in an error.

each level. From these utility levels it is possible to establish the characteristics for a grading system. The attribute with the higher part-worth utilities can be weighted more heavily in the grading system, while the less important attributes carry smaller weights. In this study, leaf attachment has the highest utility and is used a the base of the grading system. Each level of leaf attachment is assigned a grade, with the level with highest part-worth utility being the top grade. The remaining attributes are added to the grading system using the same technique.

This approach is similar to Zusman's (1967), in that consumers' utility functions are used to determine the grading system. The difference is that Zusman calculates the levels of attributes from the utility functions, while in this analysis, the levels are pre-determined. Although Zusman's approach may be more theoretically appealing, the calculations of a continuous utility function would require a large number of levels for each attribute of the product. The resulting questionnaires would be impractical to administer.

6.0 RESULTS

6.1 Preferred Attributes

This chapter provides a discussion of the conjoint analysis results. Also discussed is the process of transforming the preferred attributes of hay identified by the conjoint analysis into a grading system for hay. The results of the conjoint analysis indicate that the price of the hay is the most important variable, followed by leaf attachment, colour, and lastly protein. Table 6.1 shows the results of the regression on the data. To avoid the dummy variable trap, each attribute was tested without one level. For example, colour was tested with bright green and dark green. Light green was not included.

Table 6. 1 Conjoint Analysis Regression Results

Variable	Estimated Coefficient	Standard Error	T-Statistic
Constant	6.5400	0.30529	21.422
Bright Green	0.58833	0.27869	2.1111
Dark Green	0.61583	0.28557	2.1565
Leaf Attachment > 90%	1.3408	0.31159	4.3033
Leaf Attachment 90% > X > 75%	0.79583	0.31159	2.5541
Protein > 20%	0.41083	0.28557	1.4386
Protein 20% > X > 18%	0.52833	0.27869	1.8958
Price $250/ton	-2.3742	0.37906	-6.2633
Price $220/ton	-0.64667	0.24927	-2.5943
F-Statistic		14.7305	

With the exception of protein greater than 20 percent, all of the coefficients are statistically significant at the 95 percent level. The F-statistic is significant at the 99 percent level. The F-statistic significance level is based on 8 degrees of freedom for the numerator and 441 degrees of freedom for the denominator.

The two coefficients to describe the colour attribute, bright green and dark green have a positive sign, which was expected, but the magnitude of the bright green level was hypothesized to greater than the dark green. A possible

reason for this discrepancy is that the respondents to the survey are more familiar with the dark green alfalfa hay. The difference is slight, however, and should not effect the results significantly.

The coefficients for the levels of protein and leaf attachment have the expected sign and the hypothesized magnitude. The magnitude of the protein level between 20 and 18 percent was hypothesized to be slightly higher than protein greater than 20 percent because of the misconception amongst horse owners that too much protein is a problem.

The estimated coefficients for the attribute levels that were not included in the regression are set at zero, and the other variables are scaled to yield positive numbers. In the case of the colour attribute, the estimated coefficient for bright green is 0.58833, dark green is 0.61583 and light green is 0.0. When one of the coefficients is set to zero, the estimated coefficients also become the part-worth utilities of the attribute. Any one of the attribute levels can be set to zero and excluded from the regression, because the results are the same after the lowest coefficient for a group of attribute levels is set equal to zero. This holds because the range between the levels of the attribute does not change.

The regression constant is equal to the value of the bundle of missing attribute levels, as viewed by the respondents. For this analysis, the coefficient for the constant equals 6.54. This coefficient represents the value of light green hay, with a leaf attachment of 50 to 75 percent, and a protein level

between 15 and 18 percent, at a price of $190 per ton. Increasing the leaf attachment to greater than 90 percent would raise the value of the hay to 7.88 on a 0 to 10 scale. Using a different bundle of hay as the constant, would change the value of the constant, but similar bundles of hay would still have the same value regardless of the constant bundle of hay.

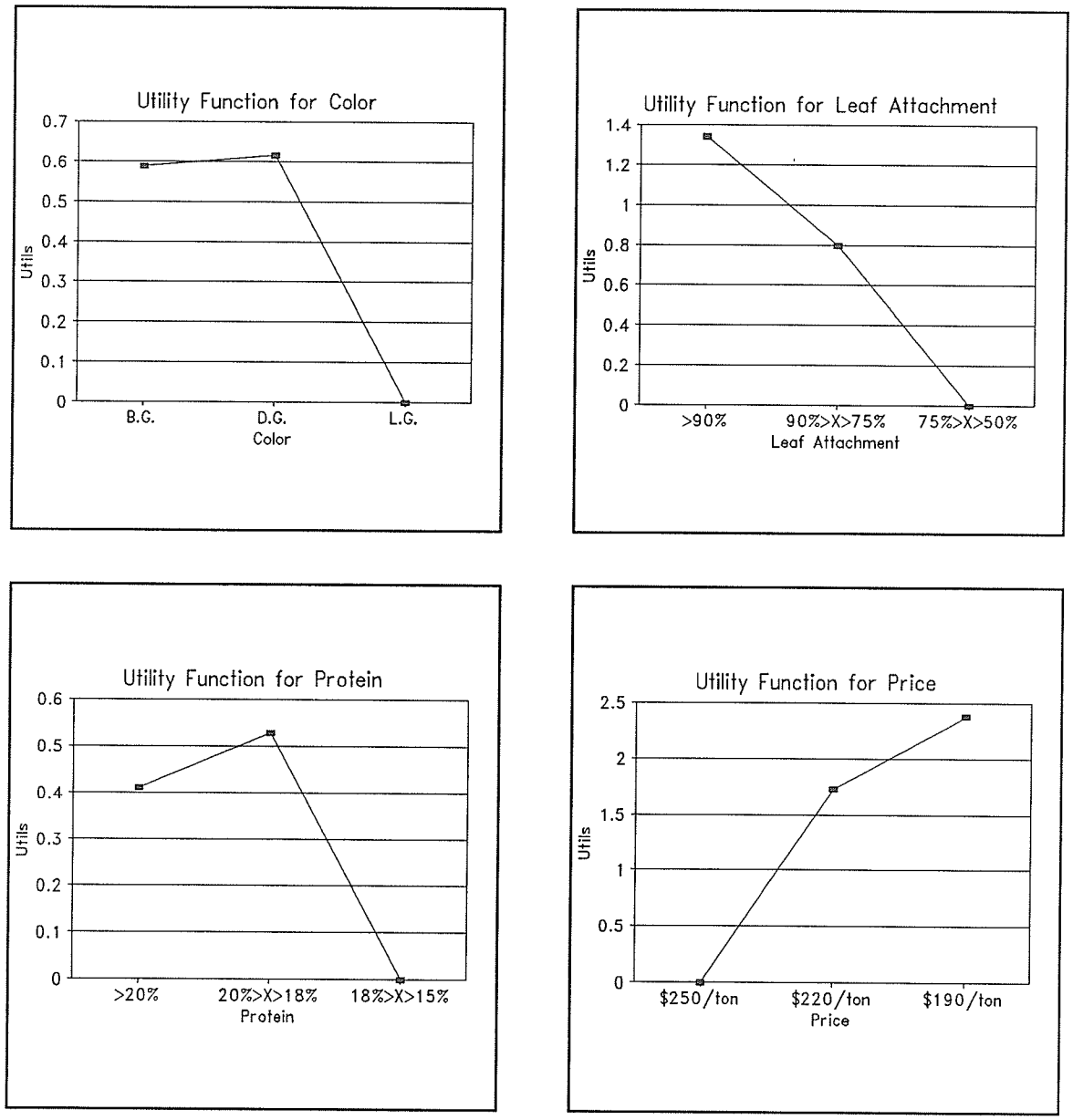
Table 6.2 presents the part-worth utilities for the four attributes tested. The part-worth utilities are totalled for each attribute to determine the total utility of the attribute. The utilities of each attribute are summed to determine the percentage of importance that each attribute has in the product. It is important to remember that the conjoint analysis is an ordinal measure. The CA method indicates which attributes are more important, but not by how much.

Table 6.2 Part-Worth Utilities of the Attributes

Attribute	Part-Worth Utilities	Attribute Range	Percent Importance
Colour		0.61583	12.7%
Bright Green	0.58833		
Dark Green	0.61583		
Light Green	0.00000		
Leaf Attachment		1.3408	27.5%
> 90%	1.3408		
75% > X > 90%	0.79583		
50% > X > 75%	0.0000		
Protein		0.52833	10.9%
> 20%	0.41083		
18% > X > 20%	0.52833		
15% > X > 18%	0.00000		
Price		2.3742	48.9%
$250 per ton	0.0000		
$220 per ton	1.7275		
$190 per ton	2.3742		

The estimated coefficients represent the marginal utility of the consumers for the attribute being tested. Each estimated coefficient is assumed to represent the number of "utils" that the specified level of the attribute provides to an "average" consumer in this group. The util is an arbitrary measure used in utility functions to show preference or increasing or decreasing utility. Figure 6.1 displays the utility functions for each attribute tested.

Figure 6.1 Utility Functions for Each Attribute



The utility function for colour indicates negligible differences between dark green and bright green hay, while both are preferred over light green hay. This was not an expected result, because bright green hay is considered better

quality than dark green hay by hay experts surveyed.

The utility function for leaf attachment is almost a linear relationship. That implies that consumers are very sensitive to changes in leaf attachment. Consequently, this is an important attribute to build into a consumer based grading system.

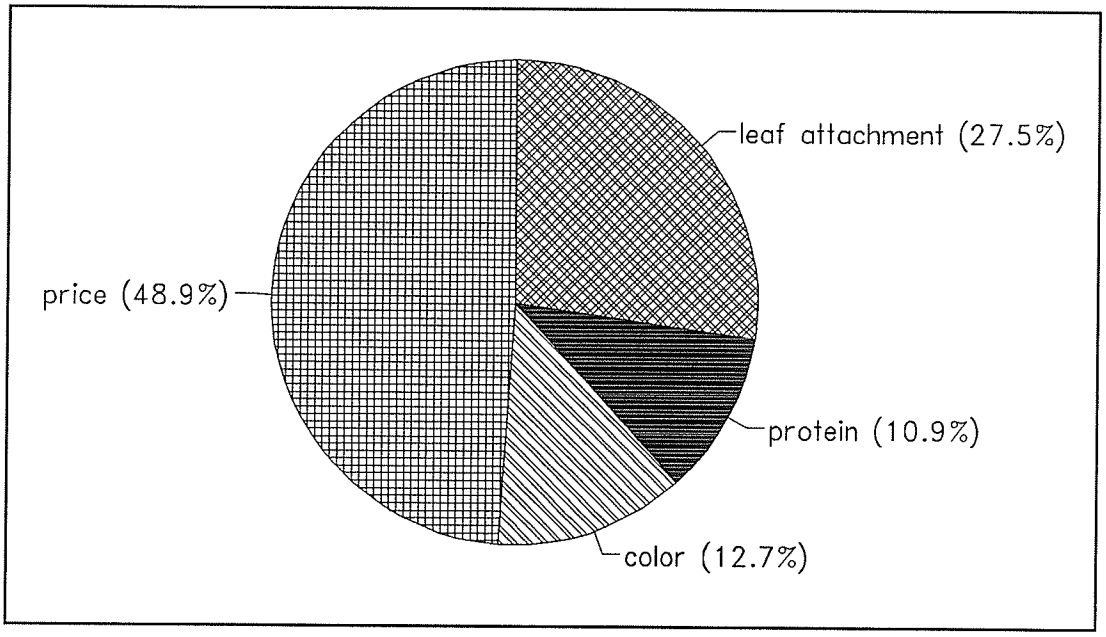
The utility function for protein takes on its maximum value at the mid-point instead of the end. As mentioned earlier, the horse owners in Florida assume that high levels of protein are detrimental to the growth of the horse. This in turn affects the utility received from the protein.

The price attribute was included to determine how important it is to consumers, but also to discover the shape of the utility function. This indirect utility function for price indicates that the curve is levelling off. From this, it is evident that consumers are willing to pay up to a certain price for the hay, but are reluctant to pay more regardless of the quality.

The importance of each attribute is determined by the percentage represented by the range of estimated coefficients, relative to the sum of the ranges for all attributes. The proportions of the total utility represented by each attribute gives an ordinal measure of importance as viewed by the respondents. The importance of the attributes is presented in Figure 6.2. Price is the most important attribute, followed by leaf attachment, colour, and lastly protein. One cannot say that price is twice as important as leaf attachment, because the conjoint analysis does not provide that information. There is enough

information, however, to develop a grading system based on consumer preferences. This procedure is outlined in the following section.

Figure 6.2 Relative Importance of Attributes in the Florida Horse Industry



6.2 Consumer Based Hay Grading System

The hay grading system should reflect the preferences of consumers purchasing the hay, in order to be used effectively in the market place. The results from the conjoint analysis were used to develop the foundation of the grading system. Due to the limitations of conjoint analysis in terms of number of variables tested at once, individuals participating in the hay markets were questioned to determine the correct attributes to include in the test. The

individuals surveyed included local hay experts, hay dealers in Florida, and horse experts. A check was also incorporated into the survey of the farm managers to ensure the right variables were chosen. Refer to Appendix C, section 3 for the attributes included.

The results indicate that the managers for horse farms are more concerned about appearance than the chemical composition of the hay. The price of the hay was considered to be the top priority. The list of attributes in descending order, excluding price is as follows: leaf attachment; colour; stem size; protein level; odour; moisture level; maturity; origin of the hay; mixture of grass and alfalfa; size and shape of the bale; and finally chemical analysis. These results are in line with the results from the conjoint analysis. Although stem size is more important to the hay buyers than protein content, protein content was viewed as a better attribute to include in the conjoint analysis because it is difficult to determine through visual inspection.

By combining the results from section 3 of the survey and the results from the conjoint analysis, a grading system was developed. Leaf attachment was chosen to be the most important variable. Colour and protein were the other attributes included in the grading system.

Leaf attachment is important to the horse owners because the leaves contain most of the digestible energy available to the horse. Alfalfa with low percentages of leaf attachment is not palatable to the horse, because of the large proportion of stems. Therefore the horse owners request high levels of

leaf attachment. Leaf attachment is a difficult attribute to measure accurately. The procedure used for the Manitoba hay certification program is to shake a handful of alfalfa and estimate the percentage of leafs that are lost.

Colour is important to the owner, but not to the horse. Hay buyers use colour as an indicator of quality. The bright green and dark green colours are believed to be high in nutritional value and appetizing to the horse. As well, these colours suggest producer's care in handling and storing high quality alfalfa. The light green and the brown alfalfa is believed to be low in nutrient value, because of bleaching by the sun or rain. Colour can be determined accurately by using colour charts.

Horse owners are less concerned about protein than some of the other quality attributes, but it is still necessary for the farm managers to formulate an efficient rations[9]. Florida hay brokers do not give protein values to their customers on a regular basis, but farm managers are starting to demand more information. The measurement of protein levels in hay is now a standard process that is recognized in the United States and Canada.

Some aspects of hay quality are constant across all grades. For example, no mould or foreign material can exist in any of the grades, and the hay must be 100 percent alfalfa. Although this grading system is developed

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[9] Horses require a varying amounts of protein depend on their age. Protein supplements are added to the feed to ensure the horse receives the required amount. By knowing the amount of protein in the hay, the farm managers can make better use of the more expensive protein supplements.

for consumers in the Florida hay markets, it should work equally well for other hay markets for horses. Florida horse farms are considered to have some of the best managed and feed programs for horses are consistent throughout North America. The preferences of the Florida farm managers should provide a good proxy for other horse operations.

The first step in the development of this grading system is to identify the attribute that buyers view as most important. In this study, leaf attachment was the most important physical variable. The Manitoba hay certification program lists four levels of leaf attachment. Although the conjoint analysis was regressed using three of these levels, the fourth is included because the grading system should be have a grade for all levels of leaf attachment to be complete. The conjoint analysis results indicated that leaf attachment is the most important attribute to base the grading system on because of the high rating provided by the CA results.

The remaining attributes included in the grading system are based on the preferences of the respondents. Colour was the next most important variable according to respondents in Florida. This attribute was added to the grading system based on the results of the conjoint analysis.

Protein was also incorporated into the grading system from the conjoint analysis results, with a slight exception. The grade 1 alfalfa has a leaf attachment greater than 90 percent, dark green colour. This is associated with high levels of protein because of the growth cycle of alfalfa. For this reason

the greater than 20 percent level of protein was included in grade 1.[10]

The designed hay grading system contains four grades. The hay certificate programs use four levels to describe most quality attributes, and four levels provides the hay buyers with a good selection. The fourth grade is not of a quality level to ship long distances, but it does provide a grade for any remaining hay.

The four grades resulting from this study are as follows:

Grade 1
Leaf attachment greater than 90 percent
Colour is dark green
Crude protein is greater than 20 percent

Grade 2
Leaf attachment between 75 and 90 percent
Colour is dark green
Crude protein is between 18 and 20 percent

Grade 3
Leaf attachment between 50 and 75 percent
Colour is light green
Crude protein is between 15 and 18 percent

Grade 4
Leaf attachment less than 50 percent
Colour is brown
Crude protein less than 15 percent

[10] As farm managers in Florida become better educated on the feed characteristics of alfalfa, it is expected that they will seek to maximize protein from hay, because it is less expensive than the supplements .

Hay would be down graded if any of the attribute levels do not meet the requirements. For example, if a bundle of hay had a leaf attachment of 80 percent, bright green colour, and 20 percent protein, it would be a grade 2. This is due to the lower leaf attachment than necessary for grade 1.

6.3 Validating the Results

The designed hay grading system is based on the response of hay dealers and hay buyers in Florida. To confirm that the grading system is acceptable a validation survey was conducted with horse owners and hay dealers in the Ocala area of Florida. A copy of the validation survey is reproduced in Appendix D. Twenty individuals in Florida were requested to judge the proposed grading system. The individuals included farm managers and hay dealers. The first section of the validation survey lists the four attributes and levels of each attribute. The respondent is asked to pick which level of each attribute is the minimum requirement for grade 1 alfalfa. The respondent is then asked which attribute decreasing would bring the hay to a grade 2. This procedure is done until grade 4.

The next section demonstrates the grading system already developed, and asks the respondent for the maximum amount that he or she would pay for each grade of hay. The last question asks what other characteristics the respondent would like to see in the grading system, and if they would use the system to purchase hay.

The results of the validation survey indicate that the hay grading system was highly regarded by 90 percent of the respondents. The remaining 10 percent of the respondents indicated that they would not use such a system.[11] One of the individuals was adamant that a grading system for hay would never work, because there are too many variables in hay quality. Another individual was a hay dealer who was currently using an informal system, but would use the system if hay buyers in the area requested it.

The validation survey suggests that the minimum levels of attributes required for the premium quality alfalfa are as follows: leaf attachment at 75 percent; dark green colour; and protein levels greater than 18 percent. This indicates that the designed grading system has a slightly higher quality standard than is necessary for the Florida region, although individuals are willing to pay extra for this quality level.

To verify that there is sufficient grade separation, individuals were asked to indicate the prices they were willing to pay for each grade. Large price differences between the grades should indicate sufficient separation. The results for the farm managers and the hay dealers were separated because the hay dealers pay less than the farm managers and would bias the survey if they were grouped together.

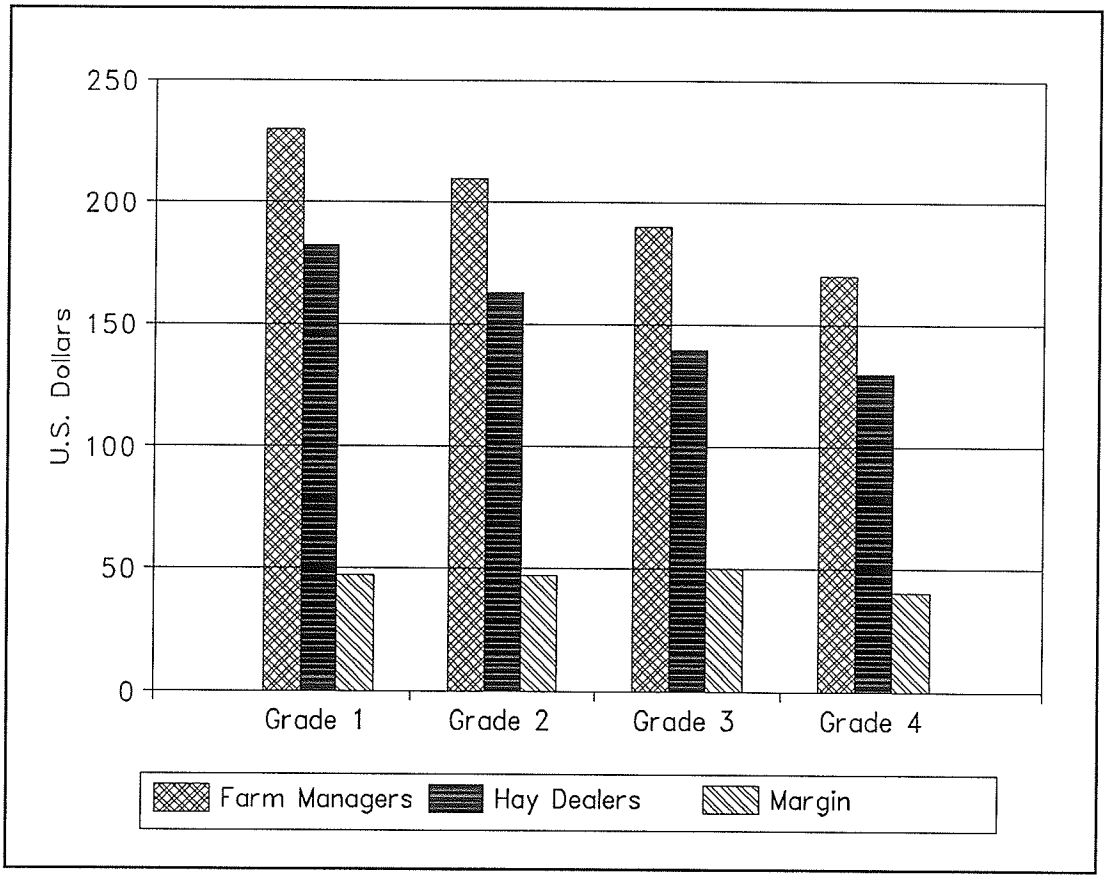
Sixteen farm managers were included in the validation survey. On

[11] Interestingly, the individuals not in favour of the designed hay grading system are hay dealers.

average, the farm managers in Ocala, Florida are willing to pay approximately US$230 per ton for Grade 1 hay. Grade 2 hay is worth US$210 per ton, Grade 3 hay is worth approximately US$190 per ton and finally Grade 4 hay is valued at US$167 per ton. The farm managers are primarily interested in Grades 1 and 2, but would buy the third grade if the upper grades were not available.

Four of the six hay dealers operating in the area also provided prices that they would be willing to pay for the respective grades. The dealers' average price for grade 1 was US$182.50 per ton, grade 2 was valued at US$162.50 per ton, grade 3 was worth US$140 per ton and grade 4 was worth US$130 per ton. Grades 3 and 4 were priced closer together than the other grades because this type of hay is not desired by the hay dealers. Figure 6.3 outlines the price individuals are willing to pay for each grade. The difference between the farm manager's price and the hay dealers price gives some insight on the broker's margin. It would appear that the hay dealers demand about US$50 per ton, regardless of the quality. The exception to this is the Grade 4 hay. The margin on Grade 4 is approximately US$40 per ton. The accuracy of the margin for Grade 4 hay is questionable, however, because this quality of hay is not purchased in the Florida hay market for horses.

Figure 6.3 Grade Pricing as Viewed By Respondents



The standard deviation was calculated for each grade to determine if the pricing indicated separate grades. Table 6.3 displays the mean and the standard deviation of the prices, as well as the confidence intervals for 95 percent.

Table 6.3 Confidence Intervals for Pricing of Grades

	Grade 1 (U.S. $)	Grade 2 (U.S. $)	Grade 3 (U.S. $)	Grade 4 (U.S. $)
Mean	228.66	208.33	188.33	167.50
Standard Deviation	6.446	5.055	8.498	5.590
95% Confidence Interval	224.97 to 232.35	205.46 to 211.20	183.46 to 193.20	164.30 to 170.70

The confidence intervals for the grades indicate significance at the 95 percent level. This implies the grades are different according to the respondents. The confidence interval was calculated using the following equation:

$$\overline{X}-(t*\frac{S}{\sqrt{N}}) \quad and \quad \overline{X}+(t*\frac{S}{\sqrt{N}})$$

where:

$\bar{x}$ = the mean of the sample

t = the t-statistic for the sample

S = the standard deviation of the sample

N = the number of observations in the sample

For example, the 95 percent confidence interval for Grade 1 is as follows:

$$228.66-(2.144*\frac{6.446}{\sqrt{14}})=224.97 \quad 228.66+(2.144*\frac{6.446}{\sqrt{14}})=232.35$$

The individuals surveyed suggested that the grades should include texture, stem size and odour. Texture is viewed as a proxy for stem size by some of the individuals surveyed, but the more knowledgable individuals explained that it is not a suitable proxy. A stem size can be fine, but also very hard, which is not palatable to horses because it cuts the inside of their mouths. The stem size could be coarse with a medium to soft texture, and the horses will still eat the hay. It was suggested that the grade system would be better if the stem size was included with texture.

Stem size is important to the horse because of palatability. The finer stems are usually easier for the horse to chew than the coarser stems. The farm managers prefer the finer stems because the horse is willing to eat more. The managers also prefer a soft texture to the hay. This is usually related to stem size, but some fine stems can be hard, and difficult for the horse to eat. Stem size can be measured several ways. The Manitoba certificate program supplies its inspectors with samples of the different sizes of stems that they can compare to the hay being tested. The approach could be improved by including a diameter measurement, with a micrometer. This would give results that are not arbitrary, and easily understood.

Odour of the hay is another attribute that the surveyed individuals felt should be added to the grading system. The Manitoba hay certification program uses three levels of odour: fresh; dull; and musty (Manitoba Forage Council, 1991). Fresh odour is described as little if any rain damage and fresh

smelling. Dull is described as having some rain damage, and not smelling fresh. Musty is described as having obvious weather damage with some mould. The Manitoba hay certification program was shown to the hay dealers and the farm managers, and both groups felt it described the hay accurately enough.

The validation survey indicates that not all the required variables are included in the grading system, but a good base for a grading system has been developed. The designed grading system has the potential to be effective without modification because it is based on the most important attributes, and an attribute that is not easily recognized. Two options exist for the continued development of a grading system: implement the base system and modify if necessary, or continue the research and test whether other quality attributes should be included.

Based on the results of the conjoint analysis, the direct questioning, and the validation survey, a new conjoint analysis model could be developed that includes leaf attachment, crude protein, texture, stem size, odour and color. It would have been more accurate to include some of the other attributes of hay in the conjoint analysis test, but there was not sufficient time or space. The test run with six variables and three levels of each would result in 64 questions. Assuming independence between the variables, and using an orthogonal array, each respondent would be asked 18 questions. The assumption of independence is not correct however, because some hay buyers do not view stem size and texture as independent. There are methods of

reducing the number of bundles the respondents have to rate, but each method has different limitations the would have to be weighed by the researcher to chose the most appropriate technique.

The designed base grading system has the potential to increase the amount of hay sold to Florida from Manitoba. As mentioned earlier, the hay buyers would no longer have to travel to perspective sellers' to inspect the hay to determine if it meets their requirements. Hay buyers can purchase based on the grades established and avoid a large percentage of the current transaction costs. Although the supply of each grade is not usually discussed in a consumer oriented grading system, Manitoba would not have trouble meeting export demand once the producers became aware of the requirements. Manitoba has the potential for large forage crops because of its growing conditions.

This base hay grading system can be compared to the optimal grading system outlined by Helmberger. The first criterion is met by this grading system, because the consumers have enough choice in grades to indicate to the producers what is desired. The economic gains from this grading system are the reduction of transaction costs associated with travel to the potential hay supplying regions on the part of the buyers. The buyers would also be more sure of the product they are receiving because of the grading system.

The validation survey tested whether there was enough difference in the grades by asking the maximum price the buyer would pay for the grade. The

results indicated that there was approximately a twenty dollar difference from grade to grade. The terminology used in the grading system is understandable because it comes from the producers and consumers of hay. The attributes of the grades are based on the Manitoba hay certification program, which for the most part use scientific methods of identification.

The grading system is open to improvements as they arise, as this represents a base. The hay grading system is a marketing tool for the producers and sellers of hay and therefore it would be in their best interest to notify the buyers if the system was to change. The cost of the hay grading system is minimal because it is incorporated with the hay certificate program. This is described in the following section on potential implementation of the grading system.

6.4 Potential Implementation of the Hay Grading System

For a grading system to be effective, it must be used by the traders of the product. This hay grading system was designed to benefit producers in Manitoba, consumers in Florida and, indirectly, hay dealers. Appendix E reviews information on the Florida hay market for horses. For the economic gains from the use of grading system to occur, individuals selling hay from Manitoba to Florida must use the system.

The provincial forage councils are in the process of moving towards a uniform certificate program. The Canadian Forage Council and Agriculture

Canada have been mentioned as potential overseers of the uniform certificate program, because of their national presence. Having Agriculture Canada administer the certificate program has advantages, because it is a government agency. This would give the hay certificate credibility in export markets. Agriculture Canada already has the power to set up and maintain a grading system, as stated in the 1985 Hay and Straw Inspection Act.

The implementation of the hay grading system involves several steps. The hay producer should have his hay certified using the hay certification program. This gives the producer a very good description of his hay. Included in the description of the hay, a grade would also be given. The producer would not need to fit his bundle of hay into the appropriate grade, and errors would be reduced. The hay dealers or farm managers are then contacted and informed as to the grade of the hay.

This requires that all parties have an understanding, or a copy of the hay grading system. Producers could accomplish that through mailing or faxing copies of the grading system to potential customers. The customer can then identify the quality of the hay, without having to travel to Manitoba to personally inspect the hay. This also allows the customers to contact producers and hay dealers and request the grade of hay they desire.

The problem of who will stand behind the grading system still exists. This is an important issue because the whole system could be undermined if unscrupulous parties enter the trade and issue falsified grades. The grading

system must be backed by an organization that both buyers and sellers view as having credibility. For distant export markets, the government might be the only rational choice because the smaller organizations are not recognized as having power to control exports.

This hay grading system is particularly sensitive to being undermined by unethical individuals working and/or incompetent inspectors. The export markets are in an infant stage from the perspective of exporting from Manitoba, and hay not properly graded will be evident. A failure of a grading system at this point could have a long term affect because buyers would be reluctant to embrace another one, if the first one is proven to be unreliable. It is essential that the hay is graded correctly for the system to be successful as an export market tool.

7.0 SUMMARY and CONCLUSIONS

7.1 Summary

Until recently, the connection between the preferences of consumers and the production capability of producers has not been linked in most agricultural grading systems.[12] Instead, grades were established on the ease of sorting readily identifiable quality characteristics. For a grading system to be effective in the marketing of agricultural commodities, it must be useful to both consumers and producers. The problem has been to establish what weights consumers would place on the identifiable quality attributes, and organize these groups of attributes into separable grade categories.

Stated preference techniques have been widely used in business marketing research to assist in the design of products and services. This thesis proposes the use of stated preferences as a means of developing the weights that consumers would place on the quality attributes of agricultural products. The development of a stated preference grading system requires information from the consumers about their choice level of attributes of a product. Conjoint analysis is one of the most widely used stated preferences techniques. The conjoint analysis determines the consumer preferences for different quality levels of attributes of the product. Based on these attribute levels, an

[12] The grain industry has recognized the importance of consumer demands, and included protein in determination of the wheat grades.

appropriate agricultural grading system can be formed that reflects consumer preferences as well as producer capabilities.

The conjoint analysis is conducted by having consumers rate multiple products bundles with different product characteristics. The results can be disaggregated using regression methods to obtain an ordinal ranking of the quality attributes as viewed by the consumers. This ranking gives the information required to establish a grading system.

The development of a grading system for alfalfa hay was used as a case study. The need for an alfalfa hay grading system was documented and introduced as early as 1906 by the Canadian parliament. Subsequently, in 1918, descriptive hay grades were established for both Eastern and Western Canadian hay, but these specific quality descriptions were deleted from the legislation in 1933. The interest in a hay grading system waned when the local demand for purchased hay decreased. Although the hay grading legislation in Canada remains in the federal statues, effectively there is no hay grades applicable for Canadian forages.

Excellent forage supplies exist in Canada and more can be developed to serve the growing worldwide demand. A grading system in the forage market would simplify international price negotiations and permit sales agreements to be reached before the cost of transportation and handling were incurred. As a result, the interest in establishing meaningful hay grade classification has been rekindled. The provincial governments in Western Canada have promoted

a "hay certification system". While the hay certification provides a detailed description of the hay quality attributes, the inspectors do not administer any grade classification to the product. Moreover, the certificate provides no guarantee that these quality attributes apply beyond the date of inspection.

For this study, consumers in the Florida hay market for horses were surveyed, because it imports 500,000 tons of hay annually. The hay grading system was designed for pure alfalfa in the Florida hay market for horses only. To design the grading system to include other types of hay would require additional conjoint analysis tests. Although designed for horses, the alfalfa grading system could be acceptable to the dairy industry as well, because of the similar hay types demanded. The hay grading system was not tested in the dairy industries, however.

The grading system was validated to ensure consumer preferences were recognized. Respondents were asked to indicate the attribute levels needed for a premium grade hay. They were then asked to indicate which attribute would have to decrease in quality to have the product be graded at the lower level. This was repeated until the fourth grade was reached. The separation between grades was tested by having the respondents reveal the price they are willing to pay for each grade of hay.

The results of the conjoint analysis and the validation produced the following hay grading system:

Grade 1
Leaf attachment greater than 90 percent
Colour is dark green
Crude protein is greater than 20 percent

Grade 2
Leaf attachment between 75 and 90 percent
Colour is dark green
Crude protein is between 18 and 20 percent

Grade 3
Leaf attachment between 50 and 75 percent
Colour is light green
Crude protein is between 15 and 18 percent

Grade 4
Leaf attachment less than 50 percent
Colour is brown
Crude protein less than 15 percent

The costs of implementing the designed hay grading system are low when used in conjunction with the Manitoba hay certification program. The hay certificate program contains all of the necessary information and could easily include a grade for the lot of hay tested. Although the Manitoba hay certification program requires fine tuning, it would be an excellent carrier for the grading system. The Manitoba hay certification program needs improvement in the methods used to measure certain hay attributes. A less subjective approach is necessary for the hay buyers in Florida to deem it acceptable.

The need for legislation is required to give the grading system credibility.

Although, a properly organized grading system has marketing benefits in the form of economic gains, which encourages its use, it should also provide the consumer some assurance of quality. The grading system must have guarantees that it will not subverted.

Two entities are interested in establishing a grading system, producers of high quality products and the buyers. The producers benefit when their product grades higher than average, and as a result, they receive increased returns. Hay buyers in Florida are requesting a grading system because of the reduction in transaction costs associated with grading systems.

7.2 Conclusions

Stated preferences methods can provide the information needed to develop an appropriate agricultural grading system for export and domestic markets. The conjoint analysis is a useful tool in the design of the consumer based grading system because it can extract information on consumer preferences for the individual characteristics of the product. The relative efficiency of the conjoint analysis versus other methods of extracting consumer preferences is not the purpose of this study.

The hay grading system appears to meet the demands of consumers in the Florida hay market for horses, as well as the producers in Manitoba. While further research should be conducted to examine other quality variables that are not included in this study, a solid base for the hay grading system has been

developed. Most consumers indicated that they would use such a system if one was available. The producers are already using the hay certificate program and appear interested in a grading system as part of the certificate program. The final test for this hay grading system would be its implementation and use in international marketing.

7.3 Limitations of the Study

This study developed a grading system for alfalfa only, and the designed system should not be extended until further research is conducted for the remaining forage products. The alfalfa grading system is also limited to the three attributes that were tested by the conjoint analysis. While the three attributes are sufficient for the initialization of export grades, it may be desirable to incorporate other quality factors.

The conclusions of this study are based on the results of hay buyers for Florida horse farms. The geographical limitation of Florida is not a serious constraint due to the horse expertise in the state. Most professional horse trainers have similar preferences for their horse's feed, so the locational differences should not have a large effect other than availability. The limitation of the study to horse owners is more significant. Differences in the feed requirements of dairy cows and horses could influence their demands for hay. The applicability of the proposed grading system for the dairy ndustry is unknown.

The use of a fractional factorial questionnaire for the conjoint analysis, limits the amount of information available to the study. This method reports the part-worth utilities, but does not provide information on the interaction between the attributes. For this reason, an assumption was made that the attributes had no effect on one and other. Based on the results of the test, this limitation does not appear to have affected the study. Whether the quality attributes that were omitted (e.g. texture) could affect these results is another matter.

A further limitation of the conjoint analysis, is that it reports only ordinal measures. A conclusion can not be reached about how much one attribute is preferred over another; just that one is more preferred. This limitation makes the results of this study less precise, than would be possible if a cardinal measure were available.

7.4 Topics for Further Research

Alfalfa was the only forage examined with the conjoint analysis, therefore the remaining export hay products should still be researched. Pure grasses and mixed alfalfa-grass hay should be studied because a demand for these products exists as well. Future researchers should be forewarned that the demand for mixed/pure grasses is more decentralized and consequently could be more difficult to analyze.

Some quality attributes of alfalfa that were deemed important to the

respondents were not included in this analysis. Further research should be conducted to determine whether they should be included and what levels should be used. Texture, stem size and odour are examples of additional quality attributes that could possibly be included in a grading system for pure alfalfa.

The conjoint analysis procedure could be used for hay cubes and pellets as well as baled hay. Canada is a major exporter of cubes and pellets, and it is possible that a grading system for these products could increase Canada's market share. A study should be conducted on the attributes that are important to the buyers, and whether a grading system could be developed that favours the quality attributes found in Canadian products (e.g. high protein levels).

The Canadian Forage Council (CFC) has expressed interest in the development of a uniform certificate program, but it is not obvious that they have the legal, or financial authority to make it viable. Can the CFC guarantee uniformity? Do they have the power to block an unscrupulous dealer from altering or falsifying grades? Agriculture Canada has hay grading legislation, but they seem to be abdicating any responsibility for implementing a hay grading system. Are they willing to delegate, or transfer authority to the provinces to administer hay grades through the CFC? The focus for this research would be the practical implementation of a hay grading system.

Although this study was directed towards the development of hay

grades, it leads into the topic of transportation. Hay is almost always moved by truck, with the exception of overseas markets, where ISO containers are used. Recent alliances in the rail industry could improve the competitiveness of the railways to move hay to North American markets. The trend towards intermodal service could expand the opportunities for hay exports. Double stacked container services could reduce the cost of moving hay for distances beyond 1200 kilometres, which would improve the competitiveness of Manitoba hay. In addition to lowering the costs of servicing the Florida market, it might create opportunities in Mexico. A study should be conducted to determine the potential for high quality hay exports to Mexico.

The dairy industry is another important export market that should be studied in greater detail. At the present time, Manitoba exports significant volumes of hay to dairy farms in the neighboring north and northeastern United States. The attributes that are important to dairy producers should be studied to allow Manitoba hay producers to better serve these markets. A grading system designed for the export markets, could potentially increase Manitoba's exports sales significantly.

Lastly, some consideration should be gven to the organization of a hay marketing commission for Manitoba forage producers. If a centralized location could be established where supplies of each hay grade could be stored for immediate shipment, it might be easier to take advantage of sales opportunities. Some importers of forage products require such large volumes

of product no single producer could possibly fill their order.

There are numerous examples in other agricultural commodities, such as hogs and potatoes, that illustrate the advantages of promotion, supply cooridination and specialized services that could be provided by a centralized selling office. In addition to helping ensure quality standards, a marketing commission could offer a customized compacting service for distribution to overseas customers. A diverse number of researchable topics are raised by this concept. How would the organization be financed? Could it operate in parallel with private traders, or would monopoly powers be required? How would it be structured in terms of operations: single storage point, or a group of strategically located storgaes?

REFERENCES

Akerlof, G.A. *The Market for Lemons: Quality Uncertainty and the Market Mechanism*, Quarterly Journal of Economics, 84, 1970.

Beauparlant, A., House of Commons Debates, vol 2, May 28, 1906.

Bennett, R.B., House of Commons Debates, vol 2, April 10, 1928.

Bretton-Clark, Conjoint Designer Version 2, Bretton-Clark, 1987

Canada Grain Council, Grain Grading for Efficiency and Profit, Canada Grain Council, 1982.

CANSIM, Canadian Socio-Economic Information Management System, Statistics Canada, 1992.

Cattin, Philippe and Dick R. Wittink, Commercial Use of Conjoint Analysis: A Survey, Draft of an article for journal publication, May 1981.

Dominion of Canada, Revised Statutes of Canada 1906, Chapter 85, 1906.

Florida Horse, 1986.

Foster, Sir George, House of Commons Debates, Vol 1, April 24, 1918.

Geramita, A.V. and Jennifer Seberry, Orthogonal Designs: Quadratic Forms and Hadamard Matrices, Marcel Dekker, Inc. New York and Basel, 1979.

Gietz R., Changes to the Canadian Beef Grading System - Proposals as of June 21, 1991, Alberta Agriculture, Market Analysis Branch, 1991.

Government of Canada, Revised Statutes of Canada 1985, Vol. V, Chapter H-2, 1985.

Green P.E. and V. Srinivasan, *Conjoint Analysis in Marketing: New Developments With Implications for Research and Practice*, Journal of Marketing, Oct 1990.

Green P.E. and V. Srinivasan, *Conjoint Analysis in Consumer Research: Issues and Outlook*, Journal of Consumer Research, Vol 5, Sept 1978.

Green P.E. and Y. Wind, *New Way to Measure Consumers' Judgments*, Harvard Business Review, July-August 1975, p 107-117

Halbrendt, C.K., F.F. Wirth, and G.F. Vaughn, *Conjoint Analysis of the Mid-Atlantic Food-Fish Market for Farm-Raised Stripped Bass*, Southern Journal of Agricultural Economics, Vol 23, July 1991.

Hahn, G.J. and S.S. Shapiro, *A catalog and Computer Program for the Design and Analysis of Orthogonal Symmetric and Assymetric Fractional Factorial Experiments*, Technical Report 66-C 165. Schenectady, NY: General Electric Research and Development Center, 1966.

Helmberger, Peter et al., A Survey of Agricultural Economics Literature. vol 3 L.R. Martin editor, University of Minnesota Press, 1981.

Jones, Robert, Modelling Consumer Preferences for Campground Design Features and Price Using Conjoint Analysis, A dissertation presented to the University of Manitoba, 1990.

Kieffer, D., President of National Hay Association, personal interview June 1992.

Kirkland, Agriculture Canada employee, personal interview June 1992.

Kohls, Richard L. and Joseph N. Uhl, Marketing of Agricultural Products, Macmillian Publishing Co., Inc. 1980.

Laffont, J.J. and E. Maskin, *Monopoly with Asymmetric Information about Quality: Behaviour and Regulation*, European Economic Review, 31 (Papers and Proceedings), p 483-9.

Lancaster, Kelvin J. *Information and Product Differentiation*, Economics of Information, Martinus Nijhoff Publishing, 1981.

Lancaster, Kelvin J. Modern Consumer Theory, Edward Elgar Publishing Limited, 1991

Lanctot, quoted in House of Commons Debates, vol 3, May 14, 1928.

Long, Barry, Farm Manager of Hidden Point Farms, personal interview April 1992

Louviere, J.J., Analyzing Decision Making: Metric Conjoint Analysis, Sage University Paper, Series No. 67 Sage Publications, 1988

Manitoba Forage Council, Hay Certification Program, 1991.

McClure, H.B., Inspection and Grading of Hay, United States Department of Agriculture, Bulletin No. 980, Washington D.C. November 16, 1921.

McFadden, Daniel, *The Choice Theory Approach to Market Research*, Marketing Science Vol. 5 No. 4 Fall 1986.

McLean, Denise, Practical Aspects of the Hay Certification Program in Saskatchewan, Paper presented to Manitoba Agri-Forum, Jan 1991.

McLean, R. and V. Anderson, Applied Factorial and Fractional Designs, New York: Marcel Dekker, 1984.

Monk, F.D., quoted in House of Commons Debates, vol 2, May 28, 1906.

Morphy, quoted in House of Commons Debates, vol 1, April 24, 1918.

Nalebuff, Barry and David Scharfstein, Testing in Models of Asymmetric Information, Princeton University, 1986.

Neill, A.W., quoted in House of Commons Debates, vol 2, Feb 17, 1933.

Nesbitt, quoted in House of Commons Debates, vol 1, April 24, 1918.

O'Neill, J.C., J. Lowenberg-Deboer, K.D. Johnson, D.C. Petritz, and W.L. Smith, Hay Preferences on Horse and Dairy Farms in Indiana and the Southeastern United States, Draft of a magazine article for Hay and Forage Grower, March 1990.

Phlips, Louis, The Economics of Imperfect Information, Cambridge University Press, 1988

Rhodes, James V., The Agricultural Marketing System, John Wiley and Sons, 1983.

Statistics Canada, Handbook of Agricultural Statistics, Part VI, Livestock and animal products, Catalogue 21-514 occasional, 1976.

Tyrchniewicz, A.J., B. Prentice and S. Jeffrey. Market Research and Feasibility Study for a Hay Compacting Operation in the Beausejour Region. A research report submitted to the Eastern Grassland Society, August 1990.

United States Department of Agriculture, Inspection and Grading of Hay, United States Department of Agriculture Bulletin No. 980, November 1921.

Varian, Hal, Microeconomic Analysis, Second edition, W.W. Norton & Company, 1984

Williams, W.F. and T.T. Stout, Economics of the Livestock-Meat Industry, New York, Macmillian, 1964.

Zusman, Pinhas, *A Theoretical Basis for Determination of Grading and Sorting Schemes*, Journal of Farm Economics. Vol 49, No. 1, Part 1, (February) 1967:89-106.

Appendix A 1918 Hay Grades of Eastern and Western Canada

The grades for Eastern Canada were as follows:
Section 340 Chapter 30 8-9 George V.

a) *Prime Timothy* shall be pure timothy, perfect in colour, sound and well cured;

b) *No. 1 Timothy* shall be timothy with not more than one-eighth of clover or other tame grasses mixed, of good colour, sound and well cured;

c) *No. 2 Timothy* shall be timothy with not more than one-third clover or other tame grasses mixed, of good colour, sound and well cured;

d) *No. 3 Timothy* shall consist of at least fifty percent of timothy and the balance of clover or other tame grasses mixed, of good colour, sound and well cured;

e) *No. 1 Clover* shall be clover with not more than one-quarter of timothy or other tame grasses mixed, of good colour, sound and well cured;

f) *No. 1 Clover Mixed* shall be timothy and clover mixed with at least one-half timothy of good colour, sound and well cured;

g) *No. 2 Clover* shall be clover with not more than one-quarter of timothy or other tame grasses mixed, of fair colour, sound and well cured;

h) *No. 1 Dyke* shall be timothy and couch with not more than one-eighth of clover or other tame grasses mixed;

i) *No. 2 Dyke* shall be timothy and couch with not more than one-third of clover or other tame grasses mixed, of fair colour, sound and well cured;

j) *Mixed Hay* shall be hay which does not come under the description of timothy or clover, and which is in good condition, of good colour, sound and well cured;

k) *No Grade* shall include all kinds of hay badly cured, grassy, or stained;

l) *Rejected Hay* shall include all hay that is musty or heated;

m) *Shipping Grade* shall be hay in good condition, pressed, sound and well cured.

The definitions of the grades for the Western hay grades are as follows:

Section 340b Chapter 30 8-9 George V.

a) *Choice Timothy Hay* shall be timothy free from stubble or weeds, with not more than one-twentieth other grasses, of bright natural colour and properly cured and sound;

b) *No. 1 Timothy Hay* shall be timothy with not more than one-eighth mixed clover or other tame grasses, and not more than one-twentieth weeds, properly cured, of good colour and sound;

c) *No. 2 Timothy Hay* shall be timothy with not more than one-fourth clover or other grasses, and not more than one-tenth weeds, of fair colour and sound;

d) *No. 3 Timothy Hay* shall included all hay showing at least one-half timothy, not more than one-fifth weeds or inferior grasses and must be sound.

e) *No. 1 Timothy Clover Mixed* shall be timothy and clover mixed with at least one-half timothy and the remainder good clover, of good colour and sound;

f) *No. 2 Timothy Clover Mixed* shall be at least one-third timothy, one-third clover with not more than one-tenth weeds and the remainder of mixed tame grasses of fair colour and sound;

g) *No. 1 Rye Grass, Brome, Orchard Grass or Alfalfa* shall be rye grass, brome, orchard grass or alfalfa, as the case may be, with not more than one-eighth of the poorer grasses and not more than one-twentieth weeds, properly cured, of good colour and sound;

h) *No. 2 Rye Grass, Brome, Orchard Grass or Alfalfa* shall be rye grass, brome, orchard grass or alfalfa, as the case may be, with not more than one-tenth of other poorer grasses, and not more than one-tenth weeds, of fair colour and sound;

i) *No. 3 Rye Grass, Brome, Orchard Grass or Alfalfa* shall include all hay showing at least one-half rye grass, brome, orchard grass or alfalfa, as the case may be, and not more than one-fifth weeds or other poorer grasses and must be sound;

j) *No Established Grade* shall include all hay not classified in the foregoing.

The Act also goes on to describe grades for wild grasses of the prairies, referring to them as Prairie Hay. The grades for prairie grasses are as follows:

a) *Choice Prairie Hay* shall be composed of seventy-five percent red top, blue joint or peavine hay or a mixture thereof, of bright colour, dry, well cured, sweet and sound, free from weeds and other objectionable matter;

b) *No. 1 Prairie Hay* shall be any one or a mixture of the following:-red top, fescue, bunch, buffalo, wheat and rye grasses, with not more than one-quarter peavine or wild vetch, all dry, well cured, of good colour, sound and reasonably free from weeds and other objectionable matter;

c) *No. 2 Prairie Hay* shall include any one or a mixture of the grasses mentioned in "No. 1 Prairie Hay" with not more than one-quarter peavine or wild vetch; all dry, of fair colour, well cured, sweet, sound, and reasonably free from weeds and other objectionable matter;

d) *No. 3 Prairie Hay* shall be any one or a mixture of the grasses mentioned in "No. 1 Prairie Hay", of fair colour, and may also contain slough or "scotch" grass of good colour, dry not caked, and reasonably free from weeds and other objectionable matter;

e) *No. 4 Prairie Hay* shall be slough grass or sedge of fair colour, not too coarse, dry, sound and reasonably free from weeds and other objectionable matter.

Appendix B Manitoba Forage Council Hay Certification Worksheet

Inspection Date _____
Producer's Name _____
Address _____
_____
Postal Code _____ RM # _____ Ph # _____

Lot Identification # (eight digit) _____
Farm Location _____ 1/4 _____ Sec _____ Twn ____ Rnge _____ E/W
Crop Year _____ Cut No. _____
Lot Size (tonnes) _____
Species type/mixture _____ Ratio _____
Bale type: Soft core Round ____ Hard core Round _____
Sm square _____ Lrg square _____
Bale size: length _____ width _____ Height _____ Diameter _____
Tying method: Twine_____ Wire_____ Other_____ # strands ____
Bale weight (kg)_____
(lbs)_____ Drying aid/preservative (y/n) _____
Brand name _____
Type of storage _____

HAY DESCRIPTION
Maturity: Legumes:

	Pre-bloom_____	Grasses:	Pre-head _____
	Early bloom ____		Early head ____
	Mid-bloom _____		Head _____
	Late-bloom _____		Post head _____

Colour:	Bright green_____	Odour:	Fresh_____
	Dark green_____		Dull_____
	Light green_____		Musty_____
	Bleach green_____		
	Brown_____	Munsell code # _____	

Leaf Attachment: 90% or better_____ 50 to 75%_____
75 to 90%_____ 50% or less_____

Stem Description:

Size:	Fine_____	Texture:	Soft_____
	Medium_____		Medium____
	Coarse_____		Hard_____

Weather damage:_____
Additional Adjustment:(N)_____ (Y)_____
Visible Mould: None_____ Light cure discolouration_____
Light brown cure_____
Dark brown cure_____
Whitemould_____

Extent of problem_____
Foreign Material/Weeds: Present_____ Absent_____
Description:_____
Injurious Foreign Material: Present____ Absent_____
Description:_____
Other Descriptive Comments:_____
_____
Sampled for standard Chemical Analysis (Y/N)_____
Additional tests requested (list):_____
_____

Billing name and address for extra analysis:
_____
_____
_____
_____

Forage Listing? (Y/N)_____ Quantity:_____
Contact name _____
Phone # _____ Best time to call _____
Price_____$/ton _____$/bale

Producer's Signature _____
Inspector's Signature _____

Appendix C Horse Producer's Survey

Section 1

1. What percentage of your hay used in your establishment do you purchase? _____

2. What type of hay do you normally purchase?
   pure alfalfa
   alfalfa-grass (type of grass in mix? _____
   grass (type of grass? _____

3. What size of bales do you normally purchase?
   small square bales
   large square bales
   small round bales
   large round bales
   Preferred weights? _____

4. What type of tie do you preferred?
   string
   plastic
   wire
   plastic bag
   no preference

5. Is the hay quality tested? _____

Section 2

I will now describe 9 packages that combine different aspects of alfalfa hay. Please rate each package on a scale of 0 to 10, where 0 is not desirable at all, and ten is very desirable. All packages have no mould and they are free of foreign material.

1. the colour is bright green
   the leaf attachment is 75 to 50% (less leafy)
   the crude protein is 18-20% on a dry matter bases
   the price is $220/ton or $6.60/ 60 lb bale
   Rating: _____

2. the colour is dark green
   the leaf attachment is greater than 95% (very leafy)
   the crude protein is 15-18% on a dry matter bases
   the price is $220/ton or $6.60/ 60 lb bale
   Rating: _____

3. the colour is dark green
the leaf attachment is 75 to 50% (less leafy)
the crude protein is greater than 20%
the price is $220/ton or $6.60/ 60 lb bale
Rating: _____

4. the colour is light green
the leaf attachment is 75 to 50% (less leafy)
the crude protein is 15-18% on a dry matter bases
the price is $190/ton or $5.70/ 60 lb bale
Rating: _____

5. the colour is light green
the leaf attachment is greater than 90% (very leafy)
the crude protein is 18-20% on a dry matter bases
the price is $250/ton or $7.50/ 60 lb bale
Rating: _____

6. the colour is light green
the leaf attachment is 90 to 75% (leafy)
the crude protein is greater than 20%
the price is $220/ton or $6.60/ 60 lb bale
Rating: _____

7. the colour is dark green
the leaf attachment is 90 to 75% (leafy)
the crude protein is 18-20% on a dry matter bases
the price is $190/ton or $5.70/ 60 lb bale
Rating: _____

8. the colour is bright green
the leaf attachment is 90 to 75% (leafy)
the crude protein is 15-18% on a dry matter bases
the price is $250/ton or $7.50/ 60 lb bale
Rating: _____

9. the colour is bright green
the leaf attachment is greater than 90% (very leafy)
the crude protein is greater than 20%
the price is $190/ton or $5.70/ 60 lb bale
Rating: _____

Section 3

I am going to read a list of statements that involve a shipment of hay. I would like to know how you feel about each statement on a scale of 0 to 10, where 0 means it is "OF LITTLE IMPORTANCE" to you, and 10 means it is "OF GREAT IMPORTANCE" to you. First is:_____. How would you rate your concern for this on a scale of 0 to 10?

1. The percentage of crude protein? 0 1 2 3 4 5 6 7 8 9 10
2. The moisture level of the hay 0 1 2 3 4 5 6 7 8 9 10
   (what is the ideal moisture level? _____)

3. The maturity of the hay 0 1 2 3 4 5 6 7 8 9 10

4. The stem size of the alfalfa 0 1 2 3 4 5 6 7 8 9 10

5. The odour of the hay 0 1 2 3 4 5 6 7 8 9 10

6. The hay comes with a chemical analysis 0 1 2 3 4 5 6 7 8 9 10
   Which chemical analysis are important to you?
   - crude protein ____
   - Digestible Energy ____
   - acid detergent fibre ____
   - neutral detergent fibre ____
   - Calcium ____
   - Phosphorus ____
   - Potassium ____
   - Sodium ____
   - Magnesium ____
   - Sulphur ____

7. The leaf attachment 0 1 2 3 4 5 6 7 8 9 10

8. The colour of the hay 0 1 2 3 4 5 6 7 8 9 10

9. The size and shape of the bale 0 1 2 3 4 5 6 7 8 9 10

10. The origin of the hay 0 1 2 3 4 5 6 7 8 9 10

11. The mixture between grass and alfalfa 0 1 2 3 4 5 6 7 8 9 10
    (what are the ideal proportions _____

12. The price of the hay 0 1 2 3 4 5 6 7 8 9 10

Section 4

Now I would like to ask a few general questions.

1. How much hay do you purchase annually? _____

2. What is the average buying price per ton for hay? _____

3. Do you use a hay broker,_____ if so what is his name, address and phone number?

_____

_____

4. Do you purchase compacted hay, _____ , would you if the hay was competitively priced and weighed 50-60 lbs. per bale? ____

5. How do you feel about Canadian hay versus hay from other parts of the U.S.?

_____

Appendix D Validation Survey

Alfalfa Grading System

Listed below are some of the main characteristics used to describe alfalfa hay. Please place a check by the level of each characteristic that you would categorize as grade 1 hay.

Leaf Attachment

- Greater than 90%
- Greater than 75%
- Greater than 50%
- Less than 50%

Colour

- Bright green
- Dark green
- Light green

Stem Size

- Fine
- Medium
- Coarse

Protein Level

- Greater than 20%
- Greater than 18%
- Greater than 15%
- Less than 15%

What characteristic drop would move the hay into grade 2?

grade3?

grade4?

Alfalfa Grading System

The following are the grades for alfalfa hay developed by my research.

All of the bundles are 100% alfalfa and are free of mould and foreign material

1) Leaf attachment greater than 90%
Colour is bright green
Protein is greater than 20%

2) Leaf attachment between 75 and 90%
Colour is dark green
Protein is between 18 and 20%

3) Leaf attachment between 50 and 75%
Colour is dark green
Protein is between 15 and 18%

4) Leaf attachment less than 50%
Colour is light green
Protein less than 15%

What is the maximum you would pay for grade 1 ? _____$/ton

What is the maximum you would pay for grade 2, _____$/ton

What is the maximum you would pay for grade 3, _____$/ton

What is the maximum you would pay for grade 4, _____$/ton

What other characteristics would you like to see in the grading system?

Appendix E Practical Information on Florida Hay Market

The Florida hay market for horses is the study region for the thesis because of the demand for imported alfalfa. Several studies have been done to determine the product demanded by the area and the quantity required. A hay marketing study was conducted at Purdue University to determine the off-farm hay demand of dairy producers and horse farms in the southeastern states (O'Neill, 1990). The survey of horse farms determined that 60 percent of the respondents preferred a 60 pound bale of alfalfa that lacks mould, also that crude protein is the most important nutritional criteria.

Another recent marketing study in Manitoba by Tyrchniewicz, Prentice and Jeffrey (1990) found that half a million tons of hay are imported by Florida on an annual basis, with much of that coming from the northern United States. The horse farms imported only eight percent of their hay from Canada. In addition, Canadian hay, which had been derived previously from Ontario and Quebec, was generally viewed as inferior quality. The problem with the Ontario and Quebec hay is the inconsistency of quality between loads and the mixture ratios between grasses and legumes.

The hay from Ontario and Quebec is normally a timothy clover mix, with a larger percentage of timothy. This type of hay is difficult to grow consistently because the clover tends to over power the timothy as the field mature. The horse industry is starting to move towards higher protein levels, reducing the demand for the timothy mixed hay and increasing the demand for

alfalfa.

Both the dairy industry and the horse industry import alfalfa hay because the quality of hay produced in the region does not meet the requirements of either industry. Interestingly, both industries demand similar quality characteristics, but for different reasons. The dairy industry desires alfalfa hay with high crude protein, low acid detergent fibre and a high net energy. The horse industry is more concerned with a visually pleasing bale than chemical content. For a bale to have a bright green colour fine stem and soft texture, as requested by the horse industry, alfalfa must be harvested during pre-bloom maturity. The pre-bloom maturity also results in significant levels of protein, as well as the low acid detergent fibre. This is a significant advantage to suppliers, because the same hay can be used in both markets.

Two problems arise in supplying both the dairy and the horse markets. First, each market demands a different sized bale. The dairy industry requires a large bale because of the quantity consumed, while the horse owners prefer a smaller bale for easier handling. The other problem facing suppliers of the Florida market is the strict quality requirements of the region. Few non-irrigated supplying regions have the capability to consistently produce large enough quantities of the high quality alfalfa demanded. Manitoba has the potential to produce the quality characteristics demanded by the Florida hay market in most years, because of the relatively dry climate conditions.

The Florida market for horse quality hay appears to controlled by a few

hay dealers in the area. The hay dealers import the alfalfa from the midwestern states and some from Canada, to supply the market. It is not uncommon for individuals to bring truckloads of hay into the area and sell directly to horse owners, but their success is limited because they are not in a position to maintain a constant supply.

One of the biggest problems for the horse owners in the area is the lack of a grading system to purchase hay with. The horse owners each have their own methods to determine their perceived quality of the alfalfa. They look at the colour of the alfalfa, the stem size, and they feel the texture. Most of them do not know the chemical make up of the alfalfa to integrate the alfalfa into their feeding program. The grading system would give the farm managers a better handle on the chemical and nutrient content of the alfalfa. This would make for a better feeding program that is more accurate.

Appendix F Horse Producers Survey Results

Section 1

1. What percentage of your hay used in your establishment do you purchase? 96.8 %

2. What type of hay do you normally purchase?

pure alfalfa	73.3%	
alfalfa-grass	22.2%	type of grass in mix, Timothy
grass	4.4%	type of grass, Coastal

3. What size of bales do you normally purchase?

small square bales	100%
large square bales	0%
small round bales	0%
large round bales	0%
	Preferred weights 72.6lbs.

4. What type of tie do you preferred?

string	55.3%
plastic	0%
wire	12.8%
plastic bag	0%
no preference	31.9%

5. Is the hay quality tested Yes - 40.4%
No - 59.6%

Section 2

I will now describe 9 packages that combine different aspects of alfalfa hay. Please rate each package on a scale of 0 to 10, where 0 is not desirable at all, and ten is very desirable. All packages have no mold and they are free of foreign material.

1. the color is bright green
the leaf attachment is 75 to 50% (less leafy)
the crude protein is 18-20% on a dry matter bases
the price is $220/ton or $6.60/ 60 lb bale
Rating: 7.0

2. the color is dark green
the leaf attachment is greater than 95% (very leafy)
the crude protein is 15-18% on a dry matter bases
the price is $220/ton or $6.60/ 60 lb bale
Rating: 7.9

3. the color is dark green
the leaf attachment is 75 to 50% (less leafy)
the crude protein is greater than 20%
the price is $220/ton or $6.60/ 60 lb bale
Rating: 6.9

4. the color is light green
the leaf attachment is 75 to 50% (less leafy)
the crude protein is 15-18% on a dry matter bases
the price is $190/ton or $5.70/ 60 lb bale
Rating: 6.5

5. the color is light green
the leaf attachment is greater than 90% (very leafy)
the crude protein is 18-20% on a dry matter bases
the price is $250/ton or $7.50/ 60 lb bale
Rating: 5.5

6. the color is light green
the leaf attachment is 90 to 75% (leafy)
the crude protein is greater than 20%
the price is $220/ton or $6.60/ 60 lb bale
Rating: 7.1

7. the color is dark green
the leaf attachment is 90 to 75% (leafy)
the crude protein is 18-20% on a dry matter bases
the price is $190/ton or $5.70/ 60 lb bale
Rating: 8.5

8. the color is bright green
the leaf attachment is 90 to 75% (leafy)
the crude protein is 15-18% on a dry matter bases
the price is $250/ton or $7.50/ 60 lb bale
Rating: 5.6

9. the color is bright green
the leaf attachment is greater than 90% (very leafy)
the crude protein is greater than 20%
the price is $190/ton or $5.70/ 60 lb bale

Rating: 8.9

Section 3

I would like to know how you feel about each statement on a scale of 0 to 10, where 0 means it is "OF LITTLE IMPORTANCE" to you, and 10 means it is "OF GREAT IMPORTANCE" to you.

1.	The percentage of crude protein?	8.1
2.	The moisture level of the hay (what is the ideal moisture level? 12%)	7.7
3.	The maturity of the hay	7.4
4.	The stem size of the alfalfa	8.0
5.	The odour of the hay	8.0
6.	The hay comes with a chemical analysis	5.6

Which chemical analysis are important to you?

crude protein	16%
Digestible Energy	____
acid detergent fibre	____
neutral detergent fibre	____
Calcium	8%
Phosphorus	8%
Potassium	____
Sodium	____
Magnesium	____
Sulphur	____

7.	The leaf attachment	8.1
8.	The colour of the hay	8.1
9.	The size and shape of the bale	5.9
10.	The origin of the hay	6.6
11.	The mixture between grass and alfalfa (what are the ideal proportions, 100% alfalfa)	7.9

Section 4

Now I would like to ask a few general questions.

1. How much hay do you purchase annually? 161 tons
2. What is the average buying price per ton for hay? US$208.70
3. Do you use a hay broker, Yes - 69.4%
   No - 30.6%
4. Do you purchase compacted hay, Yes - 32.6%
   No - 67.4%
5. How do you feel about Canadian hay versus hay from other parts of the U.S.? U.S. better - 24.6%
   Canadian better - 22.8%
   Same - 52.8%