



An analysis of the optimal allocation of resources under the provisions of the 1977 Food and Agricultural Act  
by Duane Allen Griffith

A thesis submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE  
in Applied Economics  
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**Abstract:**

This study evaluates the impact of the 1977 Food and Agriculture Act on the allocation of resources of dryland grain farms in Montana. Typical farm sizes were determined and used as representative farms in this analysis.

Implementation of the 1977 Food and Agriculture Act created many possible options for Montana grain producers. These options were included in a linear programming model which determined the optimal allocation of resources under provisions of the 1977 Food and Agriculture Act. Activities were also included to allow for nonparticipation if this proved to be the most profitable allocation of resources.

The resource base for each representative farm included: total croplable acres including summer fallow, the farm's assigned normal crop acreage, the farm's assigned program yields for wheat and barley and the acreages of wheat and barley harvested for grain in 1977.

Several factors affect the allocation of resources to competing alternatives within the Farm Program and to activities outside of the Farm Program. These factors include expected prices and yields, normal crop acreage relative to total crop acreage, willingness to plant more acreage than assigned normal crop acres and assigned program yields relative to expected yields. These factors were varied to determine their impact on allocation of resources to program and nonprogram activities for the representative farms.

Results indicate the uniqueness of each case with respect to expected prices and yields, program yields and the expressed willingness of producers to deviate from traditional crops and cultural practices. This uniqueness makes generalizations difficult to draw, and points out the need for analysis of individual farms in order to determine optimal cropping systems under the provisions of the Food and Agriculture Act of 1977.

The work done in this thesis served as the base from which MSU Agricultural Economists developed a decision model available to individual farmers via the AGNET computer system.

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June 5, 1979

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## ABSTRACT

This study evaluates the impact of the 1977 Food and Agriculture Act on the allocation of resources of dryland grain farms in Montana. Typical farm sizes were determined and used as representative farms in this analysis.

Implementation of the 1977 Food and Agriculture Act created many possible options for Montana grain producers. These options were included in a linear programming model which determined the optimal allocation of resources under provisions of the 1977 Food and Agriculture Act. Activities were also included to allow for nonparticipation if this proved to be the most profitable allocation of resources.

The resource base for each representative farm included: total croplable acres including summer fallow, the farm's assigned normal crop acreage, the farm's assigned program yields for wheat and barley and the acreages of wheat and barley harvested for grain in 1977.

Several factors affect the allocation of resources to competing alternatives within the Farm Program and to activities outside of the Farm Program. These factors include expected prices and yields, normal crop acreage relative to total crop acreage, willingness to plant more acreage than assigned normal crop acres and assigned program yields relative to expected yields. These factors were varied to determine their impact on allocation of resources to program and nonprogram activities for the representative farms.

Results indicate the uniqueness of each case with respect to expected prices and yields, program yields and the expressed willingness of producers to deviate from traditional crops and cultural practices. This uniqueness makes generalizations difficult to draw, and points out the need for analysis of individual farms in order to determine optimal cropping systems under the provisions of the Food and Agriculture Act of 1977.

The work done in this thesis served as the base from which MSU Agricultural Economists developed a decision model available to individual farmers via the AGNET computer system.

## INTRODUCTION

Wheat and barley are the major cash crops grown in Montana. Due to continued large crops and mounting stocks of these grains, the United States government developed and implemented a farm program designed to restrict supply of these crops and thereby boost the farm incomes in 1978 and beyond. This program, called "The Food and Agriculture Act of 1977", will remain in effect for a four year period.

Although government programs with similar objectives have been common in agriculture in the past, the Food and Agriculture Act of 1977 has new features which pose significant decision-making problems for Montana grain producers. These decision-making problems are associated with the flexibility the new farm program allows grain producers in determining their cropping patterns. This flexibility allows the producer to tailor his cropping enterprises to current market forces, his resource base, and personal preferences. This flexibility also dictates that a producer seeking to maximize profits examine many cropping alternatives.

## OBJECTIVES

The major objective of this study is to develop a linear programming model which will aid individual Montana dryland grain producers in selecting optimal cropping patterns under the regulations of The Food and Agriculture Act of 1977 (Farm Program).

This study has three secondary objectives. 1) To derive general conclusions concerning the impact resource bases, in combination

with enterprise returns, have on the selection and profitability of various options under the new Farm Program. 2) To determine what factors will have significant impact on a producer's decision to comply or not comply with the Farm Program. 3) To develop the decision model in a format easily adapted to AGNET, a computer based agricultural information system. This will make the decision model readily available to producers confronted with decisions regarding compliance with the Farm Program.

There are many different ways in which cropping alternatives can be evaluated. Preparation of several different complete budgets which analyze the costs and benefits associated with alternative cropping patterns is one way. Preparation of several partial budgets which analyze alternative cropping patterns is also feasible. The task of calculating complete or partial budgets to analyze the possible alternatives available to producers can become complex and does not assure an optimal allocation of resources. A more efficient method of optimizing the income from cropping alternatives is through the use of linear programming.

The use of linear programming requires the specification of an objective function, the set of activities producers may participate in and restrictions on use of resources. The objective function used in this study maximizes returns over variable costs and resource restrictions are limits placed on the use of the resource base for each

representative farm. Many of the restrictions placed on representative farms arise from the rules producers must follow to comply with the Farm Program.

When using linear programming a decision must be made with respect to the complexity and detail of the model. A relatively simple linear programming model, emphasizing the constraints government program compliance places on the use of resources, was sufficient to accomplish the objectives of this study.

Two decision periods are relevant to this analysis. One decision period is before fall crops are planted and the other before spring crops are planted. The linear programming model for the fall decision period provides a profit maximizing solution utilizing the information provided at that time. However, as input and output prices change and more information becomes available through time on expected crop yields or as the rules of the Farm Program are modified, a different cropping system may result in profit maximization when spring planting decisions are made. This study concentrates on the fall planting period but a model for the spring planting period is presented and explained also<sup>1/</sup>.

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<sup>1/</sup> See Appendix A for a detailed listing of the spring and fall decision models and an explanation of the differences between the spring and fall decision models.

The data for the linear programming model is presented using a representative farm approach. Three sizes of farms with respect to acres of cropland were established based on information gathered at a series of meetings with Montana grain producers. Enterprise cost studies developed by the Cooperative Extension Service in 1978 were also utilized.

## THE FARM PROGRAM

The Food and Agriculture Act of 1977 brought with it a new farm program. This program was designed and implemented in an effort to reduce the planted acreage of selected feed and food grains while providing an acceptable level of farm income through price supports and direct payments. To achieve this goal, the authors of the Farm Program employed some new concepts while retaining old ones.

A discussion of the Farm Program will prove useful before getting into the actual analysis of the Farm Program cropping options. This discussion will be presented in two parts. The first section is a discussion of the general aspects of the Farm Program. This section also describes the resource base for each of the representative farms used in analyzing the Farm Program. The second section is a discussion of the rules for complying with the Farm Program when producing the major dryland program crops in Montana.

### THE FARM PROGRAM IN GENERAL

One of the new elements of this Farm Program is the concept of normal crop acres (NCA). Closely associated with NCA are NCA crops. NCA crops are crops that require or use up an acre, plus the set-aside requirement, if any, of NCA for every acre of the particular crop planted.

The Agricultural Stabilization and Conservation Service (ASCS) County Committee was given the task of assigning each grain producer

in their county an NCA base for his operation. To do this, the ASCS has to determine which crops grown in Montana were to be designated as NCA crops. This list of crops includes wheat, barley, corn, oats, rye, sugar beets, flax, grain sorghum, sunflowers and dry edible beans. To derive the NCA for each producer, the ASCS County Committee used the sum of NCA crops the producer has planted in 1977 plus any volunteer acreages of NCA crops harvested for grain as reported by the producer. The NCA each producer received may not have been the simple sum of acreages of NCA crops he reported in 1977. After receiving the reported NCA crops and their planted acreages, the ASCS County Committee reviewed each producer's report and made revisions to allow for special situations which would affect reported NCA. These situations include producers who farm in an odd-even rotation or had acreage they were prevented from planting in 1977. Besides the adjustments stated above, other adjustments could be made if the situation warranted<sup>2/</sup>. The NCA adjustment process for individual producers is limited to plus or minus one percent of the county NCA over the four year period from 1977-1981. There are exemptions and provisions for adjusting producer's NCA's if the one percent limit is exceeded<sup>3/</sup>.

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<sup>2/</sup> United States Department of Agriculture, Agricultural Stabilization and Conservation Service, Feed Grain, Rice, Upland Cotton and Wheat Programs Handbook, Revision Three, February 8, 1978, Montana Notice 5-PA (Rev. 3) Par. 27.

<sup>3/</sup> USDA, ASCS, Montana Notice 5-Pa (Rev. 3) Par. 27 Idem.

The NCA was also split between the NCA crops which the producer normally grew. For example, if a producer received an NCA of 1,000 acres in total, it would be split into the acreages of NCA crops he normally grew. This may have been 500 acres of wheat and 500 acres of barley or any other combination of acreages of NCA crops.

The particular crop mix a producer reported is important because this crop mix influences the amount of acres he could plant under various options of the Farm Program.

After receiving NCA notices, producers had a fifteen day appeal period during which they could present arguments for revisions of their total NCA or the crop mix, of which their NCA was composed. The NCA producers received after adjustment by the County ASCS Committee and appeals by the producer serves as a base for that farm from 1977 through the 1981 production periods.

#### Program Yields

Another task allocated to the ASCS County Committee was to assign program yields to each producer who grew wheat and/or barley. The State ASCS Committee provided each county with a program yield for that county based on historic yields obtained from the Economics, Statistics and Cooperative Service (ESCS). The base period used for obtaining the county program yield was 1974 through 1976. Historic yields, for each NCA crop which required a program yield, were averaged to obtain an initial county yield. The initial county yield was

adjusted through established procedures to arrive at final program yields for each county<sup>4/</sup>. A complete list of program yields by county and by crop is given in the Appendix<sup>5/</sup>.

When assigning individual producer's program yields the ASCS County Committee considered a particular producers operation with respect to other producers in that county as well as the program yields assigned to that county by the State ASCS Committee. Whenever an upward adjustment was made to an individuals program yields, this dictated a downward adjustment in another individuals program yields for the same crop. These offsetting adjustments were necessary to maintain the county program yields assigned by the State ASCS Committee.

It should be noted there are four NCA crops which have program yields associated with them in Montana (wheat, barley, corn, grain sorghum), but only two of these four were used in this study. Corn and grain sorghum are raised by only a few producers in Montana so these crops were not considered in this study.

#### Resource Base

The combination of four items: acres of NCA, program yield, crop mix and total cropland make up the resource base of the representative farms used in the analysis. There are obviously other

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<sup>4/</sup> USDA, ASCS, Montana Notice 5-Pa-105, Ibid.

<sup>5/</sup> See Appendix C for a complete list of program yields assigned to all counties in Montana.

factors important in the production of small grains, but of these four items, three are designated for individual farms by the County ASCS Committee and they determine not only the options available to a producer, but also to some extent, the possible benefits the producer can receive by participating in the program. The fourth factor, total cropland, is considered because of its' possible impact on the producer's willingness to participate in the Farm Program. Factors of production not included in this study have a bearing on revenues a producer will receive from the farming enterprise but have little to do with benefits he can receive from growing crops in compliance with the Farm Program. Therefore, only acres of NCA, program yield, crop mix, and total cropland are included as important characteristics of the representative farms.

#### Offsetting Compliance

Producers who lease farmland in addition to their own operations must meet offsetting compliance regulations imposed by the Farm Program. If a producer participates in the Farm Program by growing NCA crops on his owned NCA acreage and meets all of the program provisions, the program specifies he is not able to overplant the NCA associated with the land he leases if he plants crops which have a set-aside associated with them. The producer is able to overplant the NCA on land he leases if he grows crops which have no set-aside, even though they

may be NCA crops such as oats or rye<sup>6/</sup>. The producer is also eligible to receive any program benefits associated with these non set-aside NCA crops.

Producers planting an NCA crop requiring set-aside on leased land do not have to make voluntary reductions nor meet set-aside requirements. The wheat or barley planted on the leased land under these conditions will not qualify for deficiency payments, disaster payments, Commodity Credit Corporation loans, or the Reserve Program. Wheat or barley on the leasee's owned land will qualify for all of these provisions if program requirements are met.

These rules apply to producers who operate more than two farms while owning both, as well as producers who own one farm and lease another. A problem encountered here is the definition of a farm. If a producer owns two different parcels of land and they are close together, within the same county, and farmed with the same machinery, the ASCS County Committee considers the operation to be one farm and the off-setting compliance rules would not apply.

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<sup>6/</sup> Denny, Virgil et al., Gallatin County Agricultural Stabilization and Conservation Newsletter, February 1978, p. 1.

### Cross Compliance

Cross compliance provisions of the Farm Program state that producers who wish to receive program benefits from growing one NCA crop must then grow all NCA crops in compliance with program rules<sup>7/</sup>. This means producers who wish to grow wheat and receive program benefits can not grow barley outside of the Farm Program. This holds for any combination of NCA crops which can be grown.

### Deficiency Payments

Deficiency payments were designed to support prices at an "socially acceptable" level to be determined through the legislative process. Deficiency payments are based on the target price and loan rate mechanism provided by the Farm Program. The deficiency payment is the difference between the larger of the national average loan rate or national average market price during the first five months of the marketing year and the target price for the crop in question<sup>8/</sup>. The national average market price is a weighted price from 200 locations throughout the United States taken over the first five months of the marketing year (June-October). The larger the national average market price the smaller the deficiency payment and if the national

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<sup>7/</sup> United States Department of Agriculture, Agricultural Stabilization and Conservation Service, ASCS Commodity Fact Sheet 1978 Feed Grain Program (Washington: Government Printing Office, 1978) p. 4.

<sup>8/</sup> USDA, ASCS, ASCS Commodity Fact Sheet 1978 Feed Grain Program, Ibid., p. 4.

average market price reaches or exceeds the target price then there will be no deficiency payments.

The amount of deficiency payment a producer received depends upon the program yield he has for wheat and barley, the number of acres he has planted to wheat or barley, the option he chooses to participate in, and the final determination of the allocation factor (K-factor) for partial deficiency payment options. The producer may choose to grow wheat or barley for either full or partial deficiency payments.

The effects of program yield and the amount of NCA are fairly obvious but a discussion of full or partial deficiency payments may be useful. Producers of wheat or barley, who wish to receive full deficiency payments must make voluntary acreage reductions and meet set-aside requirements, as explained later. This guarantees target price protection on 100% of the planted acreage harvested for grain. Target price protection is the payment of deficiency payments to assure producers of receiving \$3.40 per bushel for wheat or \$2.25 per bushel for barley.

Producers who chose the partial deficiency payment option will receive full target price protection on 80 to 100 percent of their acres planted for harvest as grain. The exact percentage of planted acreage guaranteed target price protection depends on a ratio called the K-factor.

The K-factor is calculated by dividing National Program Acreage (NPA) of either food or feed grains by the acreage of food or feed grains actually harvested. The Secretary of Agriculture determines each year the NPA for both food and feed grains by calculating the amount of food and feed grains needed to meet domestic and export needs, less imports, plus any desired adjustments in carryover stocks. For 1978, this acreage has been determined as 58.1 million acres for food grains and 88.7 million acres for feed grains. After harvest is completed the acreage actually harvested of both food and feed grains will be summed and these acreages will be divided into their respective national program acreages. The resulting factor, the K-factor, is then multiplied by the producer's harvested acreage to determine the percent of his acreage which will receive full target price protection under the partial deficiency payment options. The lower limit on this ratio is 80 percent and the upper limit is 100 percent.

The Farm Program also provides for prorating deficiency payments for producers who make voluntary reductions from their 1977 planted acreage but do not make the required 20% reduction to meet requirements for full deficiency payments<sup>9/</sup>. This adjustment process was intended

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<sup>9/</sup> United States Department of Agriculture, Agricultural Stabilization and Conservation Service, Feed Grain, Rice, Upland Cotton and Wheat Program Handbook, Revision Three, February 8, 1978, Montana Notice 5-Pa (Rev. 3) Par. 139.

to treat those producers who partially complied on an equitable basis relative to those who fully complied. Prorating the deficiency payments was not justified in this analysis because of the additional number of situations that would be necessary to show the impact this might have.

The deficiency payment, for the purposes of this study, was adjusted to reflect the historic different in United States wheat and barley prices and Montana wheat and barley prices. The previous ten years United States all wheat and barley prices, as reported in the Wheat Situation Report<sup>10/</sup>, were used as an indicator of the national average market price. Since June through October is the relevant period in determining the national average market price, the same period was used to determine relationships between the United States all wheat price and the Montana all wheat price; the United States barley price and the Montana barley price. The difference in Montana all wheat price and Montana winter wheat price was also determined using the same data and time period. The differences between United States average all wheat price and Montana average all wheat price; the Montana average all wheat price and the Montana average winter wheat price was assumed to be additive.

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<sup>10/</sup> United States Department of Agriculture, Economic Research Service, Wheat Situation Report, WS-203, through WS-241.

These differences were summed to attain a difference of approximately \$.15 per bushel with the United States all wheat price being higher than the Montana winter wheat price. This same \$.15 relationship holds true for the United States barley price and the Montana barley price. This \$.15 adjustment means Montana producers will not receive deficiency payments if Montana prices have reached \$3.25 for wheat for \$2.10 for barley. Using this \$.15 per bushel differential as an indicator, when Montana winter wheat prices reach \$3.25 and barley prices reach \$2.10, then the United States wheat price should be \$3.40 and barley prices should be \$2.25 per bushel which would eliminate all deficiency payments.

#### Payment Limitations

Associated with deficiency and disaster payments are maximum limits on the payment any one producer may receive. For the 1978 crop year the maximum payment producers may receive for any one crop or combination of crops is \$40,000. In 1979, it will be \$45,000 and for 1980 and 1981, \$50,000. Payments which are exempt from these limits include prevented planting and low yield disaster payments. Income received as loans or purchases of farm commodities by the ASCS are also exempt from payment limitations,

The ASCS will make payments on leased acreage where crops or proceeds are divided according to terms of the lease, in the same proportion as the crops or proceeds are divided unless the ASCS County

Committee receives written notice that payments will be shared in some other manner.

#### Disaster Payments

Farm Program provisions include payment for disasters of two types: low yield and prevented plantings. The provisions for these payments are not carried through the full four year period of the Farm Program as are the rest of the program's provisions. Legislative authority ends for these payments in 1979 with the intention of replacing this coverage by a new crop insurance program which is still in the development stage. Eligible producers prevented from planting wheat or barley due to flood, drought, or other natural disaster beyond the producer's control will receive payment on the smaller of 1) acreage intended to be planted, or 2) the amount the 1977 acreage for harvest exceeds the 1978 acreage. The payment calculation for prevented plantings is 75% of the program yield times 33 1/3 percent of the target price.

Low yield payment will be made to producers if the total quantity harvested is less than potential production obtained by multiplying 60% of the Farm Program yield times acreage planted for harvest. The low yield payment is calculated as 50% of the target price times the deficiency in yields below the 60% level.

The Farm Program does not allow doubling up of payments to producers. For example, producers who receive either low yield or

prevented planting payments on bushels below the calculated level can not receive deficiency payments on the same bushels on which they received the disaster payments.

Set-aside

To be in compliance with rules of the Farm Program when growing wheat or barley, producers must set-aside a specified amount of land for each acre of wheat or barley they plant for harvest as grain. Planted acreage not harvested for grain because of a disaster must also be included for calculation of set-aside. There are no set-aside requirements for prevented plantings. Before land is eligible to be used as set-aside it must have been: 1) tilled in one or more of the previous three years in the production of a crop for other than hay or pasture, 2) determined by the County Committee (COC) to have been devoted in all of the previous three years to a hay crop used as hay, pasture, green chop or silage that was in a normal rotation pattern with a small grain or row crop, or 3) designated as set-aside in any one of the previous three years for which a set-aside program was in effect and was eligible when designated<sup>11/</sup>.

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<sup>11/</sup> USDA, ASCS, Montana Notice 5-Pa (Rev. 3) Par. 41 op. cit.

If land meets the three requirements stated above then the following land is also eligible for use as set-aside: 1) land which will promote highway safety or will improve highway scenery, 2) small or irregular areas of cropland along streams or drainage ditches devoted to vegetative cover which can be used as a filter strip to reduce siltation of the stream or ditch. Land which is not eligible for use as set-aside includes: 1) land which is designated as set-aside under any other program, 2) land for which a prevented planting, low yield, or deficiency payment is made in the same calendar year, 3) turn areas, drainage ditches, sod waterways which were constructed before the fall of the year the set-aside is needed, and 4) wet low-lying areas, droughty knobs or banks, and areas with small size or irregular slope. Farm program regulations list other ineligible tracts of land but they would have very limited application for Montana<sup>12/</sup>.

Approved cover and uses of set-aside include: annual, biennial or perennial grasses and legumes, including volunteer stands, other than weeds, which meet criteria set forth by the State Committee (STC)<sup>13/</sup> and small grains including volunteer stands other than weeds

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<sup>12/</sup> USDA, ASCS, Montana Notice 5-Pa (Rev.3) Par. 43. op. cit.

<sup>13/</sup> Ibid.

which meet criteria set forth by the STC. These stands must be clipped to prevent seed formation. Trees or shrubs planted for erosion control, shelterbelts, or other forestry purposes or for wildlife habitat during the current year or fall of the preceding year are eligible. Planting for wildlife food plots is also an approved practice given certain conditions are met<sup>14/</sup>. Acreage of crops destroyed by natural causes may be substituted for set-aside already designated if the proper conditions are met<sup>15/</sup>.

Set-aside can not be grazed during the six-month growing period of May through October, but grazing is permitted from November 1 through April 30th in Montana. The Secretary of Agriculture does have authority to allow emergency grazing of set-aside during the summer months.

The Secretary of Agriculture is required by law to announce the amounts of set-aside, if any, for wheat by August 15th and for feed grains by November 15th of the year prior to the year of harvest.

Although set-aside can be maintained several different ways, the most common method Montana producers will use will be stubble mulch. Stubble mulch is ground which was cropped the previous year and worked only slightly in the current year to control weeds. The

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<sup>14/</sup> USDA, ASCS, Montana Notice 5-Pa (Rev. 3) Par. 43. op. cit.

<sup>15/</sup> Ibid.

cover left after a minimum of tillage operations provides protection against wind and water erosion while still conserving moisture and controlling weeds. The ASCS has established guidelines for the minimum residue required on stubble mulch to meet set-aside requirements and has developed guidelines for the number of machinery operations which will leave at least the minimum residue requirement<sup>16/</sup>.

Producers may also plant crops approved by the ASCS for Agricultural Conservation Program (ACP) cost sharing to be used as set-aside. Crops planted under the ACP cost sharing program must be left in for a period of five years.

The most restrictive factor on the use of set-aside acreage is the programs' provision of not allowing any type of harvesting from the set-aside. When annual grasses or forage crops are used to satisfy set-aside requirements, they must be clipped and not grazed nor used for hay. Hay or grass which is clipped can not be baled for use as feed at a later date. When the ACP cost sharing program is used, the producer must not harvest the set-aside in any way during the first year of the program. After the first year of stand establishment, the producer can designate other acreage to meet set-aside requirements, if any, in the following years and then harvest crops he established under the ACP cost sharing program.

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<sup>16/</sup> USDA, ASCS, Montana Notice 5-Pa-112, op. cit.

The earliest date that any set-aside cover can be plowed down in preparation for fall seeding is August first.

#### Certification and Compliance

Producers who participate in the Farm Program must sign up at their local ASCS office by May first, in Montana, and at that time, state how they intend to comply. This is only a statement of intentions and not meant to be binding. By July 15th, producers must then certify they have complied with the rules of the Farm Program. The cropping pattern producers used when certifying does not have to be the same cropping pattern as their original stated intentions during the early sign up period. Signing up by the first of May only insures the producer will receive benefits the Farm Program offers while allowing additional time for him to make the final compliance decision. His stated intentions at sign-up time are also a check to see if what he plans to do will satisfy the regulations of the program. If conditions warrant, during any given year, the State ASCS Committee has the authority to change the date for the final sign-up period and also the date for certification. This allows flexibility within states which have climatic conditions which warrant consideration. It also allows for increased levels of participation through additional sign-ups.

FARM PROGRAM RULES WITH RESPECT TO  
PROGRAM CROPS IN MONTANA

The second section of this chapter is a discussion of the regulations of the Farm Program as they apply to specific crops. Only those crops and alternatives which fit Montana conditions are discussed here.

Wheat

Wheat is a program crop which requires a 20 percent voluntary reduction from the 1977 wheat base and .2 of an acre of set-aside for every acre harvested for grain. The voluntary reduction insures the producer of target price protection on 100% of his wheat acres harvested for grain. If the producer wishes to be in the program but does not wish to or cannot participate at the full deficiency payment level, he may participate under the partial deficiency payment option of the wheat program. Under the partial deficiency payment option, producers do not have to make voluntary reduction from their 1977 wheat base. Producers only need to meet the set-aside requirements which are 20 percent of the acres planted for harvest as grain.

For some producers, the partial deficiency payment option is their only available option if they want to grow wheat. This is the case if in 1977 the producer did not grow any wheat. Producers with no 1977 wheat base have no base from which they can make a voluntary reduction of 20 percent and therefore, can only participate in the

partial deficiency payment option.

Spring wheat requires the same 20 percent set-aside as winter wheat and, of course, if the producer wishes to receive the full deficiency payments he must also make a voluntary 20 percent reduction from his 1977 wheat base. If producers plant some spring wheat and some winter wheat, the voluntary 20 percent reduction may be allocated in any manner between spring wheat and winter wheat.

If a producer overplanted his wheat base and wishes to be in the wheat program under the full deficiency payment option he can come into compliance by cutting wheat for hay. This allows producers to intentionally overplant in anticipation of cutting grain for hay or staying out of the program. There are two restrictions, with respect to time, which are imposed on cutting grain for hay. The producer must cut his wheat for hay before the 15th of July. This is the date for certifying he has complied with program rules. The second restriction placed on cutting grain for hay is that it must be cut before it reaches the early dough stage of development. Wheat cut for hay does not require an acre of NCA for every acre of wheat to be cut for hay nor does the producer have to designate set-aside acres for wheat he intends to harvest as hay.

There is considerable flexibility with regard to the final date and stage in which wheat cut for hay must be harvested. The State Committee has authority to change the final date for cutting wheat for

hay as climatic conditions in the state change. When grain is left in beyond July 15th, it has more opportunity to mature past the early dough stage but it is still acceptable to be cut for hay if climatic conditions caused the extension of the compliance date.

Provisions under the wheat program include an option to graze or cut wheat for hay or silage during the summer months and receive payments. The previous discussion on cutting wheat for hay to comply with regulations of the program did not provide the producer with any type of payment. The acres producers designate to be cut for hay or grazed for payment cannot be the same acreage they intend to cut for hay in order to comply with acreage limitations of the program. The payment rate producers receive for wheat acreage, in this option, is the greater of \$.50 or the deficiency payment times the producers program yield. Producers can elect to take a partial payment of \$.25 times their program yield times the acreage they designate to be cut for hay or grazed at sign-up time.

The number of acres producers can harvest under this option of the program is limited. Producers may graze or cut for hay or silage up to 40 percent of their combined acreage of wheat and feed grains but the acreage designated for haying or grazing may be no greater than the amount of wheat planted. Producers may graze or cut for hay or silage at least 50 acres if this acreage is greater than 40 percent of their wheat and feed grain acreage.

Barley

Barley is one of several crops which come under the general heading of feed grains in the Farm Program. The feed grains considered in the Farm Program include corn, grain sorghum, barley and oats. Of these, barley and oats are the only crops considered in this study. Grain sorghum and corn are grown in Montana but only in minor amounts relative to barley and, therefore, are not considered.

There are several options producers may participate in when growing barley. These options parallel those of the wheat program closely.

To receive full deficiency payments for barley, producers must make a 20 percent reduction from the number of acres they planted to barley in 1977. In addition, they must set-aside one-tenth of an acre for every acre they plant for harvest as grain. Doing these two things, along with meeting requirements on other program crops, will assure the producer 100 percent of target price protection on his barley acreage. Producers may also participate in an additional diversion option while growing barley under the full deficiency payment option.

Barley may also be grown for partial deficiency payment. Partial deficiency payments, as explained earlier, are full deficiency payments on a portion of the planted acreage as determined by the K-factor. An additional diversion option can also be utilized if the

producer chooses the partial deficiency payment option.

For partial deficiency payments, the Farm Program requires the producer to set-aside one-tenth acre for every acre planted for harvest as grain. The additional diversion option allows the producer to meet the requirements for full or partial deficiency payments, as stated above, plus set-aside an additional one-tenth of an acre for every acre he plants for harvest as grain. He then can receive regular deficiency payments plus a payment of \$.12 times his program barley yield times the acres of barley planted for harvest as grain. If producers grow barley under this option, they may receive an advance payment of \$.06 per bushel times their barley program yield times the acreage they have planted to barley for harvest as grain under the additional diversion option. The payment rate for the additional diversion option is the same whether the producer is growing barley for full deficiency payments or partial deficiency payments.

Barley can be cut for hay to allow the producer to comply with limitations on acreage harvested for grain. Barley cut for hay must be cut before July 15th. Barley acreage cut for hay does not count against the producer's NCA nor does he have to maintain set-aside for that acreage. Barley acreage cut for hay does not contribute to the number of acres producers can hay or graze under the wheat haying or grazing option of the Farm Program while barley harvested for grain.

does.

#### Other NCA Crops

Provisions of the Farm Program consider other NCA crops on a limited basis. Oats and rye, for example, are not given target price protection although the Secretary of Agriculture has authority to establish this protection. Since there is no target price for oats or rye, producers will not receive deficiency payments for growing these crops. Producers are not required to maintain any set-aside for planting oats or rye, but acreage planted to these crops count against the producers' NCA.

Oats and rye can also be cut for hay, if cut before July 15th, to allow the producer to comply with acreage limitations of the Farm Program. As with wheat and barley, oats and rye cut for hay do not contribute to the acreage a producer can designate as being in the wheat haying or grazing option. Oats cut for grain does not contribute to the possible acreage allowed under the wheat haying or grazing option.

#### Nonprogram Crops

Nonprogram crops are crops which the Farm Program does not consider as NCA crops and are not restricted in any way. Nonprogram crops may be grown along with program crops on unused acres of NCA or summer fallow and in addition to the NCA assigned to each producer. Some of the nonprogram crops in Montana are: safflower, sorghum grown

for hay, mustard, rape, forage crops, speltz, triticales, and small grains cut for hay.

## METHODOLOGY

A discussion of the methods used to collect data and determine the profit maximizing solution for representative farms is presented in this chapter. Farms, which are representative of Montana dryland grain producers, were established with major consideration given to size in acres and crop mix. Irrigated farming operations were not considered in this study. Costs of production studies completed by the Cooperative Extension Service provided cost of production estimates for each of the crops considered. These estimates combined with expected prices, program and expected yields, acres of NCA and cropping patterns in 1977, provide the necessary data for the linear programming model.

## SOURCE OF DATA

### Crop Production Costs

Data used to construct the enterprise budgets were obtained from farmer panels in selected areas throughout Montana. In each area the County Agent assembled a group of producers which were representative of the typical dryland farm in that area. The farmer panel provided consensus information on the types of crops grown, cropping patterns, quantity and type of inputs used in production, quantity and size of a typical machinery complement along with machinery performance rates, the costs of inputs used in production of the specified crops, yields, timing of machinery operations and an inventory of buildings for the

farm size established as typical for the area.

The information provided by the farmer panel on costs of producing the selected crops was organized so it could be processed by the Oklahoma State University budget generator to arrive at cost of production estimates for each enterprise considered in each area. These cost estimates were separated into fixed costs and variable costs. The variable costs for a particular enterprise from each of the selected areas were then averaged to arrive at an average variable cost of production for selected crops in Montana.

The dryland grain production areas are represented by Enterprise Cost Studies for McCone County, Roosevelt County, Valley County, Fergus County, Chouteau County, Hill County, Glacier County, Gallatin County, Northern Yellowstone, Stillwater and Golden Valley Counties, Pondera County, Sheridan-Daniels Counties, and the Pryor-Duck Creek-Béartooth area of South Central Montana<sup>17/</sup>.

The average variable costs for each crop used in this study are presented in Table 1. Cost estimates for wheat, barley and fallow were obtained by computing a simple average of the variable costs estimated for each county. The safflower variable costs were obtained

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<sup>17/</sup> Luft, LeRoy D., Schaefer, Jerry, Griffith, Duane Enterprise Costs for Dryland Crops in Montana, See Cooperative Extension Service Bulletins 1176, 1178, 1179, 1181, 1185, 1133R, 1136R, 1138R, 1139R, 1140R, 1142R.

Table 1. Average Per Acre Variable Costs for Selected Crops in Montana, 1977-78<sup>a/</sup>.

Average Variable Costs	Winter Wheat	Spring Wheat	Barley	Fallow	Oats	Safflower
After Fallow	\$30.00	\$24.00	\$25.00	\$ 7.40	\$24.00	\$28.75
Recrop	\$34.00	\$28.00	\$29.00	-	\$28.00	\$32.75

<sup>a/</sup> See Appendix B for a detailed breakdown of the variable costs presented here.

from Roosevelt County and were assumed to be typical for the entire state. The variable costs for oats were obtained by adjusting the state average variable costs for barley<sup>18/</sup>. The variable costs for grain hay were based on an adjusted variable cost of wheat and barley for grain. The variable costs of harvesting wheat and barley for grain were subtracted from the variable costs of either wheat or barley, respectively and replaced by the variable costs of cutting the grain for hay. The hay yield for a particular crop was derived directly from the expected grain yield of that crop<sup>19/</sup>.

Recrop variable costs were obtained for each of the crops by adjustments for added fertilizer applications and the added machinery and tractor costs necessary on recropped acres. It was assumed an additional \$3.00 per acre of fertilizer was applied on recrop acreage and \$1.00 of additional machine costs were incurred to make the variable costs of recrop \$4.00 above the variable costs of fallow as shown in Table 1.

#### Level of Technology

The level of technology assumed for this study was that which is

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<sup>18/</sup> See Appendix B for a detailed breakdown of the variable costs of each crop.

<sup>19/</sup> Shaw, Art et al., Harvesting Grain for Hay as a Means of Compliance With The Farm Program in 1978, Montana State University Staff Paper in Economics, # 78-5.

expected to prevail for the duration of the Farm Program. This level of technology is described by the fertilizer management practices, machinery usage and cultural practices used by the majority of grain producers in Montana at this time.

Technology and management go hand in hand as management in large part is the ability to implement the current state of the arts with respect to technology. An average to above average level of management is assumed for this study. Management fees were not charged to any of the crop enterprises when the variable costs of producing the selected enterprise were computed.

#### Time Frame

The time frame of the Farm Program dictates return over variable costs be considered for the profit maximization criterion. The decision period encompasses only one production year which is too short for major fixed resources to be varied. Resources which were assumed to be fixed in this study were: management, machinery and equipment, farm buildings and storage facilities and land.

#### Representative Farms

To establish representative farms it was necessary to look at typical crop mixes throughout the state. The enterprise cost studies provided information on the types of crops grown and mix of crops. The cropping pattern that is important for this study is not the specific percentage of winter wheat, spring wheat, barley and

other crops, but only the percentage of wheat, regardless of type, relative to barley. Table 2 shows the combined acreage of winter wheat and spring wheat are approximately 80 percent of planted acres and barley is approximately 20 percent of planted acres. Fallowed land is nearly always 50 percent of total acres. These crop mixes are the basis for establishing the 1977 normal crop acres which influence the acreages a producer may plant under the various options of the Farm Program.

The values, shown in Table 2, for state averages were rounded to 80 percent wheat and 20 percent barley with respect to planted acres and 50 percent summer fallow with respect to total acres. These percentages were used to establish the 1977 NCA base for each representative farm size. For example, if the normal crop acres were specified at 600 by the ASCS in 1977, then the wheat base would be 480 acres and the barley base would be 120 acres.

The linear programming algorithm then uses 480 and 120 acres of wheat and barley base to determine the most profitable allocation of resources under the rules of the Farm Program.

Acres of cropable land, assigned NCA, 1977 crop mix and program yield make up the resource base of each representative farm. To complete the economic analysis, variations of the basic farms were developed and analyzed using linear programming. Variations included:











































































































































































