STAFF PAPER

MATHEMATICAL FORMULAS FOR CALCULATING NET RETURNS FROM PARTICIPATION IN GOVERNMENT FARM PROGRAMS: PROVISIONS OF THE FOOD, AGRICULTURAL, CONSERVATION AND TRADE ACT OF 1990

PATRICK T. BERENDS, JEFFERY R. WILLIAMS,
AND G. ART BARNABY

April 1991
No. 91-18

Department of Agricultural Economics
Kansas State University

MATHEMATICAL FORMULAS FOR CALCULATING NET RETURNS FROM PARTICIPATION IN GOVERNMENT FARM PROGRAMS: PROVISIONS OF THE FOOD, AGRICULTURAL, CONSERVATION AND TRADE ACT OF 1990

PATRICK T. BERENDS, JEFFERY R. WILLIAMS, AND G. ART BARNABY

April 1991
No. 91-18

*Research Assistant, Professor and Professor, Department of Agricultural Economics, Kansas State University, Manhattan, KS 66506.

KSU
KANSAS STATE UNIVERSITY

Department of Agricultural Economics
Kansas State University, Manhattan, Kansas 66506

Mathematical Formulas for Calculating Net Returns from Participation in Government Farm Programs: Provisions of the Food, Agricultural, Conservation and Trade Act of 1990[1]

Patrick T. Berends[2]
Jeffery R. Williams
G. Art Barnaby

April 1991

[1] Contribution no. 91-464-D from the Kansas Agricultural Experiment Station.

[2] Research assistant, a professor, and a professor, respectively, Department of Agricultural Economics, Kansas State University, Manhattan, Kansas 66506. The authors acknowledge the helpful review comments made by Andy Barkley and Barry Flinchbaugh.

INTRODUCTION

The purpose of this report is to provide a revised version of the publication, "Mathematical Formulas for Calculating Net Returns from Participation in Government Farm Programs for Major Crops in Kansas: Commodity Program, Crop Insurance, Conservation Reserve, and Disaster Aid" (Williams, Harper, and Barnaby 1989). The mathematical formulas for calculating net returns presented in the earlier version are revised by incorporating changes legislated by the Food, Agricultural, Conservation and Trade Act of 1990 (FACT). These include major revisions caused by changes in the 0/92 program, the new FLEX acreage provision, and the new Integrated Farm Management Program Option (IFM). Individuals conducting research and education programs will be able to use this revision for reference when estimating net returns for farm operators under current program provisions.

Nine scenarios for government program participation are examined in this report:

1. No Commodity Program;
2. No Commodity Program with Crop Insurance;
3. No Commodity Program with the Conservation Reserve Program;
4. No Commodity Program with Crop Insurance and the Conservation Reserve Program;
5. Commodity Program only;
6. Commodity Program with Crop Insurance;
7. Commodity Program with the Conservation Reserve Program;
8. Commodity Program with Crop Insurance and the Conservation Reserve Program;
9. Commodity Program with Integrated Farm Management Program Option.

The previous staff paper described scenarios involving disaster aid. Disaster aid is typically available on an intermittent basis, but there is no permanent program scheduled for 1991 or future years. Hence, scenarios involving it are not discussed in this report. Also, the optional paid land diversion program, available in previous years as authorized by the 1985 Food Security Act, was reauthorized in the 1990 Farm Bill. However, the program is not currently offered by the USDA and, therefore, is not included in the scenarios.

The equations contained in this report can be used to calculate net returns for single crop or multi-crop enterprises that may or may not be enrolled in or eligible for government programs. Calculations can be done on a cash or total cost basis: total costs including the opportunity costs required to estimate net returns to management; labor and management; or land, labor, and management.

Scenarios 1 - 4 describe the estimation of net returns when the farm enterprises under consideration are not enrolled in the government commodity program. Scenarios 5 - 9 characterize the estimation of net returns when one or more of the farm enterprises are enrolled in the government commodity program. (Note: attention to the variables' subscripts is particularly important in scenarios 5 - 9).

Prices and parameter values that pertain to 1991 government programs can be found in Table 1. This report reflects the provisions as of April 1991. Some provisions may change or be reinterpreted from time to time. Although they do not affect the formulas in this report, the calculations of program yields for new irrigated crops are still being formulated by the United States Department of Agriculture (USDA), Agricultural Stabilization and Conservation Service (ASCS) at publication time. Additionally, some

information is location specific, such as crop insurance premium rates, or farm specific, such as program yields, and, therefore, must be provided by the user.

NON-PARTICIPATION IN COMMODITY PROGRAMS

The equations in this section are used to estimate net returns when a farm operator is not enrolled in the government commodity program. Formulas for estimating net returns for non-participation along with the use of crop insurance and/or participation in the conservation reserve program are also included.

Scenario 1. No Commodity Program

Equation (1) describes the estimation of net returns when no enterprises are enrolled in any government program. Net returns are a function of commodity prices, yields, grazing value, and cost of production estimates. This scenario has no price protection, yield protection, or income supplementation.[1] The equation is:

$$\sum_{i=1}^{n} NR_i = \sum_{i=1}^{n} \{[(P_i * Y_i) - VC_i - FC_i + GV_i] * PA_i\} \quad (1)$$

where:

i = crop i being produced on farm,

NR_i = net returns, crop i ($),

P_i = market price, crop i ($/unit),

---

[1] Income supplementation refers to additional income the farmer may receive from participation in certain programs, as it relates to that crop. It does not include non-farm income.

Y_i = average yield on planted acreage (unit/acre),

VC_i = variable costs of production ($/acre),

FC_i = fixed costs ($/acre),

GV_i = grazing value ($/acre), and

PA_i = planted acres, crop i.

Scenario 2. <u>No Commodity Program with Crop Insurance</u>

Equation (2) describes the option of purchasing crop insurance. Crop insurance premiums are deducted from gross income because the premiums are a cost of production. If a farmer does collect a crop insurance indemnity payment, then it is added to gross income.

Traditionally, insurable yields are determined by the Federal Crop Insurance Corporation (FCIC) for areas identified as having similar soil types, production practices, yields, and crop loss histories. Insurable crop yields are based on the Actual Production History (APH) for each farm. Under the APH method, insurable yields are based on average farm yields when there are three or more years of verifiable records. If the farm has 10 or more years of records, the latest 10 year average is used.

Once the insurable yield is established, a yield guarantee level and an indemnity price election are selected by the farm manager. Yield guarantees of 50%, 65%, and 75% of the APH yield are currently available from the FCIC. The indemnity price election indicates the value of possible crop loss to the farm and is selected from three possible values. If the harvested yield is less than the yield guarantee, an indemnity payment is received. The indemnity payment is calculated by taking the difference

between the yield guarantee and the harvested yield and multiplying this difference by the previously chosen indemnity price.

Premium rates are predetermined by the FCIC and are based on historical yields, production, and crop loss for the county in which the farm is located. The premium depends on the amount of coverage desired and the APH yield level. Crop insurance cost per acre is found by multiplying the yield guarantee level by the indemnity price election and by the premium rate supplied by the FCIC (Barnaby, 1987).

Crop insurance provides protection from production risk. It is not intended to provide protection from price risk. The indemnity price election is used to value the crop that is lost and does not reflect the value lost if market prices are above the price election selected. In addition, crop insurance does not provide price protection when the harvested yield is above the yield guarantee selected (a condition that results in no indemnity payments). Only when a producer suffers a loss in excess of the yield guarantee and market prices are below the indemnity price selected does some degree of price protection exist.

The equation for estimating net returns with crop insurance is:

$$\sum_{i=1}^{n} NR_i = \sum_{i=1}^{n} \{[(P_i * Y_i) - VC_i - FC_i - CI_i + GV_i + \max\{0, IP_i * [(IY_i * LC_i) - Y_i]\}] * PA_i\} \quad (2)$$

where:

CI_i = crop insurance premium ($/acre),

where:

$$CI_i = IP_i * LC_i * IY_i * PR_i \quad (2.1)$$

IY_i = insurance yield (unit/acre) (10 year yield based on actual production history for insurance or assigned with the assistance of the FCIC),

IP_i = commodity indemnity price election ($/unit) (three price elections available: low, medium, or high),

LC_i = level of coverage (three levels available: 50%, 65%, or 75%), and

PR_i = premium rate (set by FCIC).

Scenario 3. No Commodity Program with the Conservation Reserve Program

The 1990 Farm Bill provides for targeting of water quality and other environmental concerns in addition to highly erodible land. This provision, called the Environment Conservation Acreage Reserve Program (ECARP), is a revision of the conservation provision of the Food Security Act (Farm Bill) of 1985, which established the Conservation Reserve Program (CRP). The ECARP consists of the CRP and the Wetlands Reserve Program (WRP). Under WRP, land owners must provide a 30 year or perpetual easement (subject to a maximum term specified by state laws) and agree to implement a wetland restoration and protection plan. Payments may be made over a 5 to 20 year period or in a lump sum if the easement is perpetual. Funding for WRP has not been appropriated by Congress as of publication time for this report.

The CRP is a voluntary program encouraging farmers to establish permanent grass, wildlife cover, or trees on highly erodible cropland through 10-year contracts with the United States Department of Agriculture (USDA). Although the CRP is not targeted to provide protection from yield or price variability, it can have that effect because a guaranteed rental payment is received in return for not growing crops on the land in CRP. Planted acres are reduced for participants in the CRP. Acreage enrolled in the previous CRP is considered enrolled in ECARP.

Annual payments are made over the course of 10 years for CRP acreage, based on bids submitted and approved by the USDA. The maximum rental payment a participant may receive from the CRP is $50,000 in a given year. However, CRP rental payments are not included in the maximum payment limitations of other USDA programs. CRP acres cannot be used for grazing under normal circumstances, although the USDA may approve grazing in emergency situations.

Equation (3) includes the impact of CRP payments on net returns.

$$\sum_{i=1}^{n} NR_i = \sum_{i=1}^{n} \{[[(P_i * Y_i) - VC_i - FC_i + GV_i] * PA_i] - [(MC_i + EC_i + FC_i) * CRA_i]\} + \min\{\sum_{i=1}^{n}(CRRP_i * CRA_i), \$50{,}000\} \quad (3)$$

where:

MC_i = maintenance cost on non-crop acres (CRP acres) ($/acre),

EC_i = annualized establishment costs of CRP acres ($/acre),

CRA_i = conservation reserve acreage (acres), and

$CRRP_i$ = conservation reserve rental payment ($/acre).

Scenario 4. <u>No Commodity Program with Crop Insurance and the Conservation Reserve Program</u>

Either crop insurance or the CRP may be used by farm operators not participating in government commodity programs. Equation (4) describes how net returns can be estimated when both programs are selected. Neither the provisions for crop insurance nor the CRP change, if both are selected. Equation (4) is defined as:

$$\sum_{i=1}^{n} NR_i = \sum_{i=1}^{n} \{[[(P_i * Y_i) - VC_i - FC_i - CI_i + GV_i + \max\{0, IP_i * [(IY_i * LC_i) - Y_i]\}] * PA_i] - [(MC_i + EC_i + FC_i) * CRA_i]\} + \min\{\sum_{i=1}^{n}(CRRP_i * CRA_i), \$50{,}000\} \quad (4)$$

The variables are defined as before.

COMMODITY PROGRAM PARTICIPATION

The following five scenarios are used for estimating net returns when the farm operator participates in government commodity programs. Equations for estimating net returns for participation in these programs with the purchase of crop insurance and/or participation in the CRP are also described.

The Commodity Program and the 1990 Farm Bill

When farm operators decide to participate in the commodity program, they elect to forgo the potential income from crop production on acres diverted in compliance with the Acreage Reduction Program (ARP) in exchange for minimum price protection (target price) on an established average crop yield (program yield). Participating farmers receive a deficiency payment per unit of program yield, based on the difference between the target price and the market price or the effective loan rate (whichever difference is smaller). If the market price exceeds the target price, no deficiency payments are received. The deficiency payment received is in addition to the income received from the sale of the crop produced. The deficiency payment per unit of

measure is multiplied by the farm's program yield for the specific program crop to determine the deficiency payment per acre. Commodity program payments are limited to $50,000 per operator plus a maximum of $75,000 from "Findley" payments and marketing loans. Findley payments are calculated as the difference between the formula loan rate and the maximum of the effective loan rate or 12-month national average price, multiplied by program yield and the number of payment acres, provided the five-month national average price is below the formula loan rate and equal to or above the effective loan rate. If the five-month national average price exceeds the formula loan rate, no Findley payments are received.

Like previous farm bills, participating farmers have to meet ARP guidelines. However, beginning in 1991, they must also remove an additional 15% of their base acreage from deficiency payment eligibility. These acres are called the "normal" flex acres (these acres are sometimes referred to as "Triple Base Acres"). Farmers, at their choosing, may also remove up to an additional 10% of their base acres as "optional" flex acres. On flex acres, farmers may grow any crop approved by the USDA (except fruit and vegetables), but the acres are ineligible to receive any government payments.[2] In short, crops on flex acres provide returns similar to crops not employing the commodity program (e.g., Scenario 1). However, flex acres cannot reduce or increase a crop's base acreage on a farm.

---

[2] For example, suppose a farmer wants to determine the amount of acres eligible for deficiency payments. Assume the farm has a 100 acre base for wheat, a 15% ARP, and 15% FLEX requirements. The farm would be eligible for deficiency payments on 70 acres (100 - 15 - 15 = 70 payment acres). These are the Maximum Payment Acres on that farm. If the farmer utilized the additional 10% optional flex acres, payment acres would be reduced by 10, to 60 maximum payment acres.

Farmers may also participate in the commodity program's 0/92 option. With this option, farmers may plant anywhere from 0% to 92% of their eligible payment acres and receive deficiency payments on the portion of the eligible 0/92 acres left in resource conserving use. The deficiency payment is received on a maximum of 92% of the payment acres and is guaranteed at a minimum level that is equal to the USDA projected deficiency payment for the program crop in question (Barnaby, 1991).

Prior to the 1990 Farm Bill, farmers were prohibited from harvesting any crops on 0/92 acres. Beginning in 1991, farmers will have the option of harvesting minor oilseed crops, approved by the USDA, on 0/92 acres. Farmers that do so have two options. One, they may receive deficiency payments for the program crop and forgo eligibility for all marketing loans regarding that minor oilseed crop. Two, they may retain marketing loan eligibility, but they must forego deficiency payments on 0/92 acres. Also, farmers may choose not to harvest crops on 0/92 acres, as was previously done.

Additionally, FACT does not allow haying and grazing on conservation use acres (ARP, 0/92, etc., except ECARP acres) during for the five-month, principal, growing season designated by the State ASCS committee. Also, except in arid and summer fallow areas, FACT requires commodity program participants to plant an annual or perennial cover crop on 50% of ARP acres and the 0/92 acres not planted to a minor oilseed crop.

Scenario 5. Commodity Program Only

The following equations can be used to estimate net returns for producers using only the government commodity program. Equation (5) describes estimation of net returns under this scenario. The $75,000 limit relating to Findley payments may be reduced depending on returns generated by marketing loans.

$$TNR = \sum_{c=1}^{n} NR_c + \sum_{z=1}^{k} NR_z + \sum_{f=1}^{j} NR_f \qquad (5)$$

where:

TNR = total net returns,

NR_c = net returns resulting from participation in a government commodity program; excludes returns from producing oilseed crops on 0/92 acres and from producing crops on flex acres,

NR_z = net returns from producing an eligible oilseed crop on 0/92 acres, and

NR_f = net returns from producing an eligible crop on flex acres.

Returns from participating in a government commodity program:

$$\begin{aligned} \sum_{c=1}^{n} NR_c = \sum_{c=1}^{n} \{ & [[(\max\{P_c, EL_c\} * Y_c) - VC_c - FC_c + GV_c] * PA_c] - \\ & \{(MC_c + FC_c - OSGV_c) * (ARP_c + NCUA_c + NCFA_c)\} + \\ & \{\min(\sum_{c=1}^{n} PAY_c - [FDP_c * PY_c * PA_c]), \$50{,}000) + \\ & \min(\sum_{c=1}^{n} [FDP_c * PY_c * PA_c], \$75{,}000)\}\} \end{aligned} \qquad (5.1)$$

where:

c = crop c, an eligible crop for participation in the government commodity programs,

P_c = market price, crop c ($/unit),

FL_c = formula loan rate, crop c ($/unit),

Y_c = average yield on planted acreage, crop c (unit/acre),

VC_c = variable costs of production, crop c ($/acre),

FC_c = fixed costs ($/acre),

GV_c = grazing value ($/acre),

PA_c = acres of crop c planted and eligible for deficiency payments;

where:

$$PA_c = MPA_c - CUA_c \quad (5.2)$$

MPA_c = maximum payment acres, crop c;

where:

$$MPA_c = BA_c - ARP_c - FLEX_c \quad (5.3)$$

BA_c = base acres, crop c,

ARP_c = acreage reduction program acres,

where:

$$ARP_c = ARR_c * BA_c \quad (5.4)$$

ARR_c = acreage reduction requirement (% of BA_c),

$FLEX_c$ = flex acreage (% of BA_c),

CUA_c = conservation use acreage (0/92 option) (between 0 and 92% of MPA_c),

MC_c = maintenance cost on diverted acres ($/acre),

$OSGV_c$ = off-season grazing value ($/acre),

$NCUA_c$ = acres of CUA_c planted to a resource conserving use crop (excludes acres allocated to minor oilseeds),

$NCFA_c$ = non-crop $FLEX_c$ acres, (i.e., acres left as a green manure crop),

PAY_c = government payments, crop c ($)

where:

if a farmer receives deficiency payments on 0/92 acres (and forgoes marketing loan eligibility for oilseeds), then:

$$PAY_c = \{[DP_c * PY_c * PA_c] + [\{CUA_c - (MPA_c * .08)\} * \max\{DP_c, PRCU_c\} * PY_c]\} \quad (5.5)$$

if a farmer forgoes receiving deficiency payments on 0/92 acres in order to remain eligible for oilseed marketing loans, then:

$$PAY_c = [DP_c * PY_c * PA_c] \quad (5.6)$$

DP_c = deficiency payments ($/unit),

where:

$$DP_c = \max\{[TP_c - \max(NP5_c, FL_c)], 0\} + (FDP_c, \text{ if } NP5_c < FL_c) \quad (5.7)$$

FDP_c = Findley payment ($/unit),

where:

$$FDP_c = \max\{[FL_c - \max(NP12_c, EL_c)], 0\} \quad (5.8)$$

TP_c = target price ($/unit),

$NP5_c$ = national average price, five-month base ($/unit),

$NP12_c$ = national average price, 12-month base ($/unit),

EL_c = effective national average loan rate, crop c ($/unit),

PY_c = program yield (bu/acre), and

$PRCU_c$ = guaranteed payment rate on 0/92 acreage, which is equal to the estimated (projected) deficiency payment ($/unit)

Returns from oilseed crops planted on 0/92 acres:[3]

If a farmer receives deficiency payments on 0/92 acres and forgoes eligibility for oilseed marketing loans, then:

$$\sum_{z=1}^{k} NR_z = \sum_{z=1}^{k} \{[(P_z * Y_z) - VC_z - FC_z] * CUA_z\} \quad (5.9)$$

If a farmer forgoes deficiency payments on 0/92 acres to retain eligibility for oilseed marketing loans, then:

$$\sum_{z=1}^{k} NR_z = \sum_{z=1}^{k} \{[[P_z + \max((ML_z - WP_z), 0) * Y_z] - VC_z - FC_z] * CUA_z\} \quad (5.10)$$

where:

z = an eligible minor oilseed crop z (as determined by the USDA),

P_z = market price, minor oilseed crop z ($/unit),

Y_z = yield, minor oilseed crop z (unit/acre),

VC_z = variable cost of producing minor oilseed crop z ($/acre),

---

[3] NR_z only includes returns from crop production on 0/92 acreage. Deficiency payments from 0/92 participation are included in NR_c in the PAY_c variable.

FC_z = fixed costs ($/acre),

CUA_z = conservation use acres allocated to minor oilseed crop z[4],

ML_z = effective marketing loan rate for minor oilseed crop z ($/unit),

WP_z = world market price for minor oilseed crop z ($/unit).

Returns from crops planted on flex acres:

$$\sum_{f=1}^{j} NR_f = \sum_{f=1}^{j} \{[(\max (P_f, EL_f) * Y_f) - VC_f - FC_f - GV_f] * FLEX_f\} \quad (5.11)$$

where:

f = eligible crops for production of flex acres (as determined by the USDA),

P_f = market price, crop f ($/unit),

EL_f = effective national average loan rate, if crop f is a commodity program crop ($/unit),

Y_f = average yield on planted acreage (unit/acre),

VC_f = variable cost of producing crop f ($/acre),

FC_f = fixed costs ($/acre),

GV_f = grazing value ($/acre), and

$FLEX_f$ = flex acres planted to crop f,[5]

---

[4] Returns associated with conservation use acres that are not planted to minor oilseeds are accounted for in equation (5.1) under the $NCUA_c$ variable.

[5] Returns associated with flex acres that are not planted to a crop are accounted for in equation (5.1) under the $NCFA_c$ variable.

Scenario 6. Commodity Program with Crop Insurance

Government programs help reduce income variability but do not provide income replacement for yield losses. The following equations describe how net returns can be estimated, while accounting for crop insurance when the farm operator also participates in the government commodity program. The same payment limits specified before remain for this scenario.

The equations are:

$$TNR = \sum_{c=1}^{n} NR_c + \sum_{z=1}^{k} NR_z + \sum_{f=1}^{j} NR_f \qquad (6)$$

Returns from participating in a government commodity program:

$$\begin{aligned}\sum_{c=1}^{n} NR_c = \; & \sum_{c=1}^{n}\{[[(\max\{P_c, EL_c\} * Y_c) - VC_c - CI_c - FC_c + GV_c \\ & + \max\{0, IP_c * [(IY_c * LC_c) - Y_c]\}] * PA_c] - \\ & \{(MC_c + FC_c - OSGV_c) * (ARP_c + NCUA_c + NCFA_c)\} + \\ & \{\min(\sum_{c=1}^{n} PAY_c - [FDP_c * PY_c * PA_c]), \$50{,}000) + \\ & \min(\sum_{c=1}^{n} [FDP_c * PY_c * PA_c], \$75{,}000)\}\}\end{aligned} \qquad (6.1)$$

where:

CI_c = crop insurance premium ($/acre),

where:

$$CI_c = IP_c * LC_c * IY_c * PR_c \qquad (6.2)$$

IY_c = insurance yield (unit/acre) (10-year yield based on actual production history for insurance or assigned with the assistance of the FCIC),

IP_c = commodity indemnity price election ($/unit) (three price elections available: low, medium, high),

LC_c = level of coverage (three levels available: 50%, 65%, or 75%), and

PR_c = premium rate (set by FCIC).

Returns from oilseed crops planted on 0/92 acres, with crop insurance:

If a farmer receives deficiency payments on 0/92 acres and forgoes eligibility for oilseed marketing loans, then:

$$\sum_{z=1}^{k} NR_z = \sum_{z=1}^{k} \{[[(P_z * Y_z) - VC_z - CI_z - FC_z] + \max\{0, IP_z * [(IY_z * LC_z) - Y_z]\}] * CUA_z\} \quad (6.3)$$

If a farmer forgoes deficiency payments on 0/92 acres to retain eligibility for oilseed marketing loans, then:

$$\sum_{z=1}^{k} NR_z = \sum_{z=1}^{k} \{[[P_z + \max((ML_z - WP_z), 0) * Y_z] - VC_z - CI_z - FC_z] + \max\{0, IP_z * [(IY_z * LC_z) - Y_z]\}] * CUA_z\} \quad (6.4)$$

Returns from crops planted on flex acres, with crop insurance:

$$\sum_{f=1}^{j} NR_f = \sum_{f=1}^{j} \{[(\max (P_f, EL_f) * Y_f) - VC_f - CI_f - FC_f - GV_f] + \max\{0, IP_f * [(IY_f * LC_f) - Y_f]\}] * FLEX_f\} \quad (6.5)$$

Scenario 7. Commodity Program with the Conservation Reserve Program

The government commodity program, including optional programs, can be used in conjunction with the CRP. Acres diverted into CUA and FLEX are ineligible for CRP participation. The relationships that affect net returns when a farm operator participates in the commodity program and the CRP are described by the following equations.

$$TNR = \sum_{c=1}^{n} NR_c + \sum_{z=1}^{k} NR_z + \sum_{f=1}^{j} NR_f \tag{7}$$

Returns from participating in a government commodity program:

$$\begin{aligned}\sum_{c=1}^{n} NR_c = \; & \sum_{c=1}^{n} \{[[(\max\{P_c, EL_c\} * Y_c) - VC_c - FC_c + GV_c] * PA_c] - \\ & \{(MC_c + FC_c - OSGV_c) * (ARP_c + NCUA_c + NCFA_c)\} - \\ & \{(MC_c + EC_c + FC_c) * CRA_c\} + \min\{\sum_{c=1}^{n}(CRRP_c * CRA_c), \\ & \$50{,}000\} + \{\min(\sum_{c=1}^{n} PAY_c - [FDP_c * PY_c * PA_c]), \$50{,}000) + \\ & \min(\sum_{c=1}^{n} [FDP_c * PY_c * PA_c], \$75{,}000)\}\}\end{aligned} \tag{7.1}$$

where:

EC_c = Annualized establishment costs of CRP acres ($/acres),

CRA_c = conservation reserve acreage (acres), and

$CRRP_c$ = conservation reserve rental payment ($/acre).

Returns from oilseed crops planted on 0/92 acres (acres are ineligible for the CRP program):

If a farmer receives deficiency payments on 0/92 acres and forgoes eligibility for oilseed marketing loans, then:

$$\sum_{z=1}^{k} NR_z = \sum_{z=1}^{k} \{[(P_z * Y_z) - VC_z - FC_z] * CUA_z\} \quad (7.2)$$

If a farmer forgoes deficiency payments on 0/92 acres to retain eligibility for oilseed marketing loans, then:

$$\sum_{z=1}^{k} NR_z = \sum_{z=1}^{k} \{[[P_z + \max((ML_z - WP_z), 0) * Y_z] - VC_z - FC_z] * CUA_z\} \quad (7.3)$$

Returns from crops planted on flex acres (acres are ineligible for the CRP program):

$$\sum_{f=1}^{j} NR_f = \sum_{f=1}^{j} \{[(\max (P_f, EL_f) * Y_f) - VC_f - FC_f - GV_f] * FLEX_f\} \quad (7.4)$$

Scenario 8. <u>Commodity Program with Crop Insurance and the Conservation Reserve Program</u>

Crop insurance can be purchased by producers participating in the government commodity program and the conservation reserve program. The following equations describe how to estimate net returns when the farm operator simultaneously participates in the aforementioned programs.

$$TNR = \sum_{c=1}^{n} NR_c + \sum_{z=1}^{k} NR_z + \sum_{f=1}^{j} NR_f \quad (8)$$

Returns from participating in a government commodity program:

$$\sum_{c=1}^{n} NR_c = \sum_{c=1}^{n} \{[[(\max\{P_c, EL_c\} * Y_c) - VC_c - CI_c - FC_c + GV_c + \max\{0, IP_c * [(IY_c * LC_c) - Y_c]\}] * PA_c] - \{(MC_c + FC_c - OSGV_c) * (ARP_c + NCUA_c + NCFA_c)\} - \{(MC_c + EC_c + FC_c) * CRA_c\} + \min\{\sum_{c=1}^{n}(CRRP_c * CRA_c), \$50{,}000\} + \{\min(\sum_{c=1}^{n} PAY_c - [FDP_c * PY_c * PA_c]), \$50{,}000) + \min(\sum_{c=1}^{n} [FDP_c * PY_c * PA_c], \$75{,}000)\}\} \quad (8.1)$$

Returns from oilseed crops planted on 0/92 acres, with crop insurance (0/92 acres are ineligible for the CRP program):

If a farmer receives deficiency payments on 0/92 acres and forgoes eligibility for oilseed marketing loans, then:

$$\sum_{z=1}^{k} NR_z = \sum_{z=1}^{k} \{[[(P_z * Y_z) - VC_z - CI_z - FC_z] + \max\{0, IP_z * [(IY_z * LC_z) - Y_z]\}] * CUA_z\} \quad (8.2)$$

If a farmer forgoes deficiency payments on 0/92 acres to retain eligibility for oilseed marketing loans, then:

$$\sum_{z=1}^{k} NR_z = \sum_{z=1}^{k} \{[[P_z + \max((ML_z - WP_z), 0) * Y_z] - VC_z - CI_z - FC_z] + \max\{0, IP_z * [(IY_z * LC_z) - Y_z]\}] * CUA_z\} \quad (8.3)$$

Returns from crops planted on flex acres, with crop insurance (flex acres are ineligible for the CRP program):

$$\sum_{f=1}^{j} NR_f = \sum_{f=1}^{j} \{[(\max(P_f, EL_f) * Y_f) - VC_f - CI_f - FC_f - GV_f] + \max\{0, IP_f * [(IY_f * LC_f) - Y_f]\}] * FLEX_f\} \quad (8.4)$$

Scenario 9. <u>Commodity Program with the Integrated Farm Management Program Option.</u>

Commodity program participants will have a new option available to them in 1991. The Integrated Farm Management Program Option (IFM), encourages cropping flexibility and resource conserving rotations. Participating farmers enter three- to five-year contracts with the USDA for all or part of their farm. The IFM requires that an average of 20% of all program crops' base acres be devoted to a resource-conserving crop. Planted acres in the IFM must include a legume, but not beans harvested for seed. The legume may be planted along with any grass and/or eligible, non-program, small grains like, rye, buckwheat, or triticale.

Base acreage and deficiency payments are protected under the IFM. Farmers may not harvest non-program small grain crops on the IFM acres. Acres in the IFM can not be used for hay or grazing during the five-month principle growing season established by the state ASCS committee. Unlike the 0/92 option, a minimum level for deficiency payments is not guaranteed. If a farmer selects the IFM, 50% of ARP acreage can be included in the IFM. Unlike other IFM acres, ARP acres in the IFM may be used for hay or grazing at anytime.

The following equations can be used for estimation of net returns when participating in the IFM.

$$TNR = \sum_{c=1}^{n} NR_c + \sum_{z=1}^{k} NR_z + \sum_{f=1}^{j} NR_f + \sum_{m=1}^{h} NR_m \quad (9)$$

where:

NR_m = net returns from the IFM option. Does not include deficiency payments from eligible IFM acres (these are included in NR_c via the variable PAY_c).

Returns from participating in a government commodity program:

$$\sum_{c=1}^{n} NR_c = \sum_{c=1}^{n} \{[[(\max\{P_c, EL_c\} * Y_c) - VC_c - FC_c + GV_c] * PA_c] - \quad (9.1)$$
$$\{(MC_c + FC_c - OSGV_c) * (ARP_c + NCUA_c + NCFA_c)\} +$$
$$\{\min(\sum_{c=1}^{n} PAY_c - [FDP_c * PY_c * PA_c]), \$50{,}000) +$$
$$\min(\sum_{c=1}^{n} [FDP_c * PY_c * PA_c], \$75{,}000)\}\}$$

where:

PA_c = acres of crop c, planted;

where:

$$PA_c = MPA_c - CUA_c - IFM_c \quad (9.2)$$

CUA_c = conservation use acreage (0/92 option) (between 0 and 92% of MPA_c, less IFM_c acres),

IFM_c = acres normally planted to crop c allocated to IFM. This represents acres removed from planted acres only; it does not include IFM acres under the ARP. And,

PAY_c = government payments, crop c ($)

where:

if a farmer receives deficiency payments on 0/92 acres (and forgoes marketing loan eligibility for oilseeds) and elects not to harvest small grains on IFM acres, then:

$$PAY_c = \{[DP_c * PY_c * (PA_c + IFM_c)] + [\{CUA_c - (MPA_c * .08)\} * \max\{DP_c, PRCU_c\} * PY_c]\} \quad (9.3)$$

if a farmer forgoes receiving deficiency payments on 0/92 acres in order to remain eligible for oilseed marketing loans and elects not to harvest small grains on IFM acres, then:

$$PAY_c = [DP_c * PY_c * (PA_c + IFM_c)] \quad (9.4)$$

Returns from oilseed crops planted on 0/92 acres:

If a farmer receives deficiency payments on 0/92 acres and forgoes eligibility for oilseed marketing loans, then:

$$\sum_{z=1}^{k} NR_z = \sum_{z=1}^{k} \{[(P_z * Y_z) - VC_z - FC_z] * CUA_z\} \quad (9.6)$$

If a farmer forgoes deficiency payments on 0/92 acres to retain eligibility for oilseed marketing loans, then:

$$\sum_{z=1}^{k} NR_z = \sum_{z=1}^{k} \{[[P_z + \max((ML_z - WP_z), 0) * Y_z] - VC_z - FC_z] * CUA_z\} \quad (9.7)$$

Returns from crops planted on flex acres:

$$\sum_{f=1}^{j} NR_f = \sum_{f=1}^{j} \{[(P_f * Y_f) - VC_f - FC_f - GV_f] * FLEX_f\} \quad (9.8)$$

Returns from production on IFM acres:

$$\sum_{m=1}^{h} NR_m = \sum_{m=1}^{h} \{[[(P_m * Y_m) - VC_m - FC_m] * IFM_m] + (H_m + GV_m) * ARPIF_m\} \quad (9.9)$$

where:

m = resource conserving crop m, eligible for IFM participation,

The following variables involve IFM acres removed from payment acreage. They are only relevant before, or after, the principal five-month growing season.

P_m = market price, crop m, ($/unit),

Y_m = yield, crop m (unit/acre),

VC_m = variable cost of producing crop m ($/acre),

FC_m = fixed costs ($/acre),

IFM_m = acres of m in the IFM,

The following variables involve IFM acres under the ARP being used for hay or grazing. They are relevant at anytime.

H_m = hay returns from ARP acres in the IFM,

GV_m = grazing value from ARP acres in the IFM, and

$ARPIF_m$ = ARP acres in the IFM.

SUMMARY

This report provides a revision of a 1989 report that developed mathematical formulas to calculate net returns for farm operators, given certain scenarios of government program participation. The equations developed and described in this report update the 1989 formulas by incorporating changes brought about by the 1990 Farm Bill as of April 1991. These equations can be used to facilitate research, extension, and classroom education programs that require the use of net return estimates for alternative government program scenarios.

Scenarios 1 - 4 describe the estimation of net returns when the farm enterprises under consideration are not enrolled in the government commodity program. Scenarios 5 - 9 characterize estimation of net returns when one or more of the farm enterprises is enrolled in the government commodity program. The 1989 staff paper included provisions for disaster aid and optional paid land diversion. These options are not currently available for 1991 and, thus, not included in this report.

Although government programs that supplement farm income are intermittently revised, this report can serve as a framework for future research dealing with the estimation of net returns under various government program scenarios.

TABLE 1. 1991 Parameter Values for Government Commodity Programs

Government Program	Wheat	Corn	Grain Sorghum	Soybeans	Other Oilseeds[1]
Acreage Reduction Requirement (ARR)	15%	7.5%	7.5%	N/A	N/A
FLEX Requirement	15%	15%	15%	N/A	N/A
(0/92) Option	yes	yes	yes	N/A	N/A
Target Price (TP)	$4.00/bu	$2.75/bu	$2.61/bu	N/A	N/A
Effective Loan Rate (EL)	$2.04/bu	$1.62/bu	$1.54/bu	N/A	N/A
Marketing Loan Rate (ML)[2]	N/A	N/A	N/A	$5.02/bu	$.089/lb
Payment Rate Conservation Use Acres (PRCU)[3]	$1.40/bu $1.47/bu[4]	$.58/bu	$.56/bu	N/A	N/A
Formula Loan Rate (FL)	$2.52/bu	$1.91/bu	$1.81/bu	N/A	N/A
Advance Deficiency Payment (ADP)[5]	$.56/bu $.588/bu[4]	$.232/bu	$.224/bu	N/A	N/A

[1] Sunflower, Canola, Rapeseed, Safflower, Flaxseed, and Mustard Seed

[2] Marketing loans will be reduced by a two percent origination fee.

[3] PRCU is equal to the estimated (projected) deficiency payment.

[4] Values for winter wheat farmers who elect to FLEX 15% of their base in the 90-91 crop and receive payments based on the five-month price and 75% of their base acreage.

[5] ADP is equal to 40% of the estimated (projected) deficiency payment.

N/A = Not Applicable

REFERENCES

Barnaby, G.A. "Evaluating Alternative Crops and Rotations Based on the 1991 Government Program." Cooperative Extension Service, Kansas State University, Manhattan, KS. January 1991.

Barnaby, G.A. "Multiple Peril Crop Insurance: What Is It? Should You Buy It?" Cooperative Extension Service, Kansas State University, Manhattan, KS. 1987.

Williams, J.R., J.K. Harper, and G.A. Barnaby. "Mathematical Formulas for Calculating Net Returns from Participation in Government Farm Programs for Major Crops in Kansas: Commodity Program, Crop Insurance, Conservation Reserve and Disaster Aid." Department of Agricultural Economics. Staff Paper No. 89-9. Kansas State University, Manhattan, KS. April 1989.