Programming Instructions for
Revenue Assurance Premium Calculations For 2000

American Farm Bureau Insurance Services, Inc

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1. Introduction

This document contains detailed instructions for calculating Revenue Assurance[sm] (RA[sm]) premiums in the 2000 crop year. Unless otherwise indicated, results of arithmetic calculations should be rounded to 9 digits to the right of the decimal.

2. Data and Variable Definitions

Much of the data that is required for calculation of RA[sm] premiums can be found on the actuarial pages of the APH program. A subset of the APH data will need to be found on the new RA actuarial page. The definitions of the data that are to be located on the RA actuarial page are given below. The variable names will be indexed by *j* for a crop and *i* for a unit of the crop in the equations. For example, *rateou*(*j,i)* refers to the optional unit APH rate for crop *j*, unit *i* where *j = c, s, w, cn, sf, b* refers to crop corn, soybeans, wheat, canola, sunflower, and barley.

yldR05	The mid-point of the R05 yield span for a crop in a county
rateou	The APH premium rate (as shown on the APH actuarial page) at a 65% coverage level for the crop that corresponds to a farmer's APH yield on a unit (basic or optional). The *ou* denotes that these are APH optional unit rates.
hrisk	High risk land rating factor (associated Map Area, M13, rectype 11, field 19, Map Area, pos. 94)
psurc	APH premium surcharge for cupped APH yield (M13, rectype 11, field 42, Premium Rate Surcharge, pos. 221)
minratefactor	A factor used to determine the minimum whole-farm premium rate
APHp	The APH price of the crop.
PP65	The APH prevented planting factor for a crop for 65% prevented planting coverage (associated Guarantee Reduction Factor, M13, rectype 11, field 30, Guarantee Reduction Factor, pos 149)
PP70	The APH prevented planting factor for a crop for 70% prevented planting coverage (associated Guarantee Reduction Factor, M13, rectype 11, field 30, Guarantee Reduction Factor, pos 149)

Other data used to calculate premiums are supplied by the farmer, supplied by the insurance agent, or supplied by the program. Data that is specific to each unit (basic or optional) is given below:

fyld	Approved yield for the basic (or optional) unit (M13 rectype 11, field 25, Yield, pos 113)
acre	Acres in the crop on the basic (or optional) unit (M13 rectype 11, field 31, reported acres, pos 152)
share	The farmer's share on a basic (or optional) unit of a crop (M13, rectype 11, field 34, insured share, pos. 178)

revb The selected per-acre revenue level for a basic (or optional) unit of a crop (M13, rectype 11, field 26, Dollar Amount of Insurance, pos. 121)

reve The selected per-acre revenue level for an enterprise unit (M13, rectype 11, field 26, Dollar Amount of Insurance, pos. 121)

revwf The selected per-acre revenue level for the whole-farm unit (M13, rectype 11, field 26, Dollar Amount of Insurance, pos. 121)

minreve The minimum selected per-acre revenue level for an enterprise unit

minrevwf The minimum selected per-acre revenue level for whole-farm unit

maxreve The maximum selected per-acre revenue level for an enterprise unit

maxrevwf The maximum selected per-acre revenue level for whole-farm unit

nsect Number of sections in which a crop is grown (M13, rectype 11, field 52, Number of sections, pos. 262)

The prices that are supplied by the agents are:

chip The projected harvest price of a crop (M13, rectype 11, Price Election, pos. 170)

And the variables that are supplied by FCIC are:

cvp Price volatility of the crop

Variables that are either calculated by the program or supplied by the user and directly used to calculate premiums are:

cover Coverage level on a basic (or optional) unit (M13, rectype 11, field 51, revenue Assurance Coverage Level Percent, pos. 257)

ecover Coverage level on an enterprise unit (M13, rectype 11, field 51, revenue Assurance Coverage Level Percent, pos. 257)

covwf Coverage level on a whole-farm unit (M13, rectype 11, field 51, revenue Assurance Coverage Level Percent, pos. 257)

Some other variables that are calculated by the program are:

premr Base premium rate for a basic (or optional) unit

epremr Base premium rate for an enterprise unit

wfpremr Base premium rate for a whole-farm unit

wfprem Base per-acre premium for a whole-farm unit

avgrate Weighted average APH rate for an enterprise unit

erate Adjusted average APH rate for an enterprise unit

efyld Weighted average APH yield for an enterprise unit

perlia Percent of expected liability from a crop on a whole-farm unit

LP	Per-acre loaded premium for a basic (or optional) unit (M13 rectype 11, field 37, Base Premium Rate, pos. 194)
TLP	Total loaded premium for a basic (or optional) unit (M13, rectype 11, field 43, Total Premium, pos.222)
LEP	Per-acre enterprise premium for a crop (M13 rectype 11, field 37, Base Premium Rate, pos. 194)
TLEP	Total loaded enterprise premium for a crop (M13, rectype 11, field 43, Total Premium, pos.222)
LWFP	Per-acre loaded whole-farm unit premium (M13 rectype 11, field 37, Base Premium Rate, pos. 194)
TLWFP	Total loaded whole-farm unit premium (M13, rectype 11, field 43, Total Premium, pos.222)
subaphou	Premium subsidy on an optional unit under the APH program
subaphb	Premium subsidy on a basic unit under the APH program
subaphe	Comparable APH premium subsidy for an enterprise unit
subaphwf	Comparable APH premium subsidy for a whole-farm unit
subfact	Premium subsidy factor on an optional or basic unit
subfacte	Premium subsidy factor on an enterprise unit
subfactwf	Premium subsidy factor on a whole-farm unit
psubb	Premium subsidy on a basic (or optional) unit
psube	Premium subsidy on an enterprise unit
psubwf	Premium subsidy on a whole-farm unit
TLPsub	Subsidized premium (M13, rectype 11, field 44, Producer Premium, pos.230)
TLEPsub	Subsidized enterprise premium (M13, rectype 11, field 44, Producer Premium, pos.230)
WFPsub	Subsidized whole-farm premium (M13, rectype 11, field 44, Producer Premium, pos.230)
premb	Producer paid premium per acre for a basic (or optional) unit
preme	Producer paid premium per acre for an enterprise unit
premwf	Producer paid premium per acre for a whole-farm unit

3. Minimum and Maximum Available Coverage Amounts

Revenue Assurance offers revenue guarantees that fall between 65% and 75% of the product of projected harvest price and approved yield for basic and optional units. The maximum coverage level for enterprise and whole-farm units is 85%.

Basic (or optional) units

The farmer selects a coverage level between 65% and 75%. The values for the per-acre revenue guarantees are then calculated for all crops $j = c, s, w, cn, sf, b$ and all units i, $i = 1,....,N(j)$:

$$(1) \qquad revb(j,i) = cover(j) \cdot fyld(j,i) \cdot chip(j),\ i = 1,...,N(j),\ j = c,s,w,cn,sf,b.$$

Enterprise units

The farmer selects the level of *reve*, rather than the coverage level, after being shown minimum and maximum values. The equations for these minimum and maximum values are somewhat complicated because we must sum over the number of crop units . The minimum and maximum values should be rounded to the nearest cent.

$$(2) \qquad minreve(j) = .65 \frac{chip(j)\sum_{i=1}^{N(j)} share(j,i)acre(j,i)fyld(j,i)}{\sum_{i=1}^{N(j)} share(j,i)acre(j,i)},\ j = c,s,w,cn,sf,b.$$

$$(3) \qquad maxreve(j) = .85 \frac{chip(j)\sum_{i=1}^{N(j)} share(j,i)acre(j,i)fyld(j,i)}{\sum_{i=1}^{N(j)} share(j,i)acre(j,i)},\ j = c,s,w,cn,sf,b.$$

Whole-farm unit

The farmer also selects *revwf* after being shown minimum and maximum values. The equations for these minimum and maximum values are even more complicated because we must sum over all crop units. If less than the maximum number of crops are insured in the whole-farm unit (because a farmer does not plant a covered crop in a county) then the summations are done only over the included crops.

$$(4) \qquad minrevwf = .65 \left[\sum_{j=c,s,w,cn,sf,b} \frac{chip(j)\sum_{i=1}^{N(j)} share(j,i)acre(j,i)fyld(j,i)}{\sum_{j=c,s,w,cn,sf,b} \sum_{i=1}^{N(j)} share(j,i)acre(j,i)} \right]$$

$$(5) \qquad maxrevwf = .85 \left[\sum_{j=c,s,w,cn,sf,b} \frac{chip(j)\sum_{i=1}^{N(j)} share(j,i)acre(j,i)fyld(j,i)}{\sum_{j=c,s,w,cn,sf,b} \sum_{i=1}^{N(j)} share(j,i)acre(j,i)} \right]$$

The minimum and maximum values should be rounded to the nearest cent.

4. Coverage Levels

Coverage levels are used to calculate base premium rates and revenue guarantees. Because a farmer can only select one unit structure (with the exception of optional units) the premium calculator should allow the farmer to have different coverage levels for basic (or optional) units, enterprise, and whole-farm units. The coverage levels for optional and basic units, *cover*, are supplied directly by the user. The coverage levels for enterprise and whole-farm units must be calculated by the following equations:

(6)
$$ecover(j) = \frac{reve(j)}{\frac{chip(j)\sum_{i=1}^{N(j)} share(j,i)acre(j,i)fyld(j,i)}{\sum_{i=1}^{N(j)} share(j,i)acre(j,i)}} \quad j=c,s,w,cn,sf,b$$

(7)
$$covwf = \frac{revwf}{\frac{\sum_{j=c,s,w,cn,sf,b} chip(j)\sum_{i=1}^{N(j)} share(j,i)acre(j,i)fyld(j,i)}{\sum_{j=c,s,w,cn,sf,b}\sum_{i=1}^{N(j)} share(j,i)acre(j,i)}} \quad j=c,s,w,cn,sf,b.$$

All coverage levels are rounded to four digits.

4. Basic Unit Premiums

For each basic (or optional) unit the farmer supplies the state and county where the insured crops reside and values for *fyld*, and *cover*. In addition, the farmer decides whether or not to choose the harvest price option (M13 rectype 11, RA Fall Harvest Price option, pos. 268). The state, county and whether the farmer chooses the harvest price option identifies which set of rating coefficients to use in equation (9). All single crop rating coefficients and the counties in which they apply are given in Appendix A.

The program should provide (or, alternatively, the user should supply) *yldR05* and *rateou*. <u>These values must be allowed to vary by type and practice to account for the situation where a basic unit has more than one type of practice</u>. The per-acre base premiums are then calculated using long, but straightforward, formulas.

Before using the formula the APH optional rates at 65% (*rateou*) must be multiplied by the basic unit discount (BUD = 0.9) to put the RA rates on an equivalent

basis as the APH basic unit rates. In addition, if a unit is categorized as high risk land, then *rateou* must also be multiplied by the high risk factor, *hrisk*. This rating factor changes according to the yield span for the unit; *hrisk* = 1.0 if the land is not high risk land. The variables *rate* are rounded to 9 digits to the right of the decimal.

$$(8) \qquad rate(j,i) = hrisk \cdot rateou(j,i) \cdot 0.9, \; i=1,...,N(j); \; j = c,s,w,cn,sf,b$$

When determining which value of rateou to use in equation (8) use the yield span corresponding to the approved yield calculated using APH yield procedures (*fyld*). When a yield floor affects this approved yield, do not use the yield span that would correspond to the average yield calculated had the yield floor not been in effect. This is a departure from the way that APH rates are determined.

Base premium rate

$$\begin{aligned} premr(j,i) &= beta(j,0) + beta(j,1)rate(j,i) + beta(j,2)rate(j,i)^2 + beta(j,3)cover(j) \\ &+ beta(j,4)cover(j)^2 + beta(j,5)\frac{fyld(j,i)}{yldR05(j)} + beta(j,6)\left(\frac{fyld(j,i)}{yldR05(j)}\right)^2 \\ &+ beta(j,7)cvp(j) + beta(j,8)cvp(j)^2 + beta(j,9)(rate(j,i) \cdot cover(j) \\ &+ beta(j,10)rate(j,i) \cdot \frac{fyld(j,i)}{yldR05(j)} + beta(j,11)rate(j,i) \cdot cvp(j) \\ &+ beta(j,12)cover(j) \cdot \frac{fyld(j,i)}{yldR05(j)} + beta(j,13)cover(j) \cdot cvp(j) \\ &+ beta(j,14)cvp(j) \cdot \frac{fyld(j,i)}{yldR05(j)} \quad i = 1,...,N(j); \; j=c,s,w,cn,sf,b. \end{aligned} \qquad (9)$$

This formula is used to calculate the base premium rates for each basic unit and for each optional unit for each crop.

Each individual calculation is rounded to 9 digits to the right of the decimal place, and the variable *premr* is rounded to 4 digits.

The next step is to add a prevented planting load to these base premiums and find the per-acre premiums.

Loaded per-acre premiums

The base premium rates are increased for prevented planting coverage if the farmer opts for 65% or 70% prevented planting coverage. The per-acre premium is found by multiplying the premium rate by liability and rounding to two decimals.

At 60% prevented planting

(10) $$LP(j,i) = premr(j,i) \cdot revb(j,i);\ j = c,s,w,cn,sf,b.$$

At 65% prevented planting

(11) $$LP(j,i) = premr(j,i) \cdot PP65(j) \cdot revb(j,i);\ j = c,s,w,cn,sf,b.$$

At 70% prevented planting

(12) $$LP(j,i) = premr(j,i) \cdot PP70(j) \cdot revb(j,i);\ j = c,s,w,cn,sf,b.$$

Total basic unit premiums

The total premium for a basic unit is given by the equation (13). The premium is rounded to the nearest whole-dollar amount.

(13)
$$TLP(j,i) = LP(j,i) \cdot acre(j,i) \cdot share(j,i),\ i = 1,\ldots,N(j);\ j = c,s,w,cn,sf,b.$$

Total optional unit premiums

The per-acre premium for an optional unit is found by treating the optional unit as a basic unit and then applying a 10% surcharge for all crops. **This 10% surcharge applies to all RA crops and is a change for 2000.** They are rounded to the nearest whole-dollar amount.

(14)
$$TLP(j,i) = 1.1LP(j,i) \cdot acre(j,i) \cdot share(j,i), i = 1,\ldots,N(j);\ j = c,s,w,cn,sf,b.$$

5. Enterprise Unit Premiums

The premium for an enterprise unit is found by using the same coefficients that are used to find premiums for basic or optional units. Differences in the rating equations arise if a farmer has more than one basic unit or farms in more than one section of land. These two factors change the approved farm yield and APH rate used in the equations.

Before the premiums can be calculated, *avgrate*, and *efyld* must be calculated. These quantities are simply the acreage and share weighted average of the APH yields and APH premium rates for all units of a crop in a county.

(15) $$avgrate(j) = \frac{\sum_{i=1}^{N(j)} share(j,i)acre(j,i)rate(j,i)}{\sum_{i=1}^{N(j)} share(j,i)acre(j,i)} j = c,s,w,cn,sf,b.$$

$$(16) \qquad efyld(j) = \frac{\sum_{i=1}^{N(j)} share(j,i)acre(j,i)fyld(j,i)}{\sum_{i=1}^{N(j)} share(j,i)acre(j,i)} \; j = c,s,w,cn,sf,b.$$

avgrate is rounded to 9 digits to the right of the decimal. *efyld* is rounded to one digit to the right of the decimal.

We then need to adjust *avgrate* to reflect the number of sections.

$$erate(c) = avgrate(c) \cdot (1 - (nsect(c) - 1)\frac{0.4}{9}) \quad \text{if } nsect(c) \le 10,$$
$$\text{else } erate(c) = 0.6avgrate(c)$$

$$erate(j) = avgrate(j) \cdot (1 - (nsect(j) - 1)\frac{0.5}{9}) \quad \text{if } nsect(j) \le 10, \; j = s,w,cn,sf,b.$$
$$\text{else } erate(j) = 0.5avgrate(j)$$

erate is rounded to 4 digits.

And finally, if a farmer has multiple practices across within or between units then the values for *yldR05* to be used in equation (17) is the maximum applicable value.

Base premium rate for enterprise unit

$$\begin{aligned} epremr(j) &= \text{beta}(j,0) + \text{beta}(j,1)erate(j) + \text{beta}(j,2)erate(j)^2 + \text{beta}(j,3)ecover(j) \\ &+ \text{beta}(j,4)ecover(j)^2 + \text{beta}(j,5)\frac{efyld(j)}{yldR05(j)} + \text{beta}(j,6)(\frac{efyld(j)}{yldR05(j)})^2 + \text{beta}(j,7)cvp(j) \\ &+ \text{beta}(j,8)cvp(j)^2 + \text{beta}(j,9)erate(j) \cdot ecover(j) + \text{beta}(j,10)erate(j) \cdot \frac{efyld(j)}{yldR05(j)} \\ &+ \text{beta}(j,11)erate(j) \cdot cvp(j) + \text{betac}(j,12)ecover(j) \cdot \frac{efyld(j)}{yldR05(j)} \\ &+ \text{betac}(j,13)ecover(j) \cdot cvp(j) + \text{beta}(j,14) \cdot \frac{efyld(j)}{yldR05(j)} \cdot cvp(j), j = c,s,w,cn,sf,b. \end{aligned} \quad (17)$$

Each individual calculation is rounded to 9 digits, and the variable *epremr* is rounded to 4 digits.

Per-acre enterprise unit premiums

The next step is to convert these rates into per-acre base premiums. This is done by multiplying the rate by the appropriate prevented planting factor and liability (the per-acre revenue guarantee for enterprise units) and rounding to two digits.

At 60% prevented planting

(18) $$LEP(j) = epremr(j) \cdot reve(j), \; j = c,s,w,cn,sf,b.$$

At 65% prevented planting

(19) $$LEP(j) = epremr(j) \cdot PP65(j) \cdot reve(j), \; j = c,s,w,cn,sf,b.$$

At 70% prevented planting

(20) $$LEP(j) = epremr(j) \cdot PP70(j) \cdot reve(j), \; j = c,s,w,cn,sf,b.$$

Total loaded enterprise premiums

Now we need to multiply the loaded per-acre premium by the number of insured acres on the each unit. The result will be rounded to whole-dollars. The total enterprise premium is found by summing over all units. **Rounding on a record by record basis is a major change for RA 2000 (M13, rectype 11, field 43, Total Premium, pos.222). This change will remove the need for proration for DAS.**

(21) $$TLEP(j) = \sum_{i=1}^{N(j)} \text{round}(LEP(j) \cdot acre(j,i) share(j,i), 0); \quad j = c,s,w,cn,sf,b.$$

6. Whole-Farm Unit Premium

Calculation of whole-farm premium follows the same procedure as calculation of premium for the other unit structures. However, because there are up to six crops involved, the equations for whole-farm premiums are significantly longer. To facilitate programming, the rating coefficients and rating factors (variables) that are multiplied together and then added to come up with the whole-farm premium are presented as columns below.

The values for the coefficients in **betawf** depend on which crops are in the whole-farm unit and on whether the farmer chooses the harvest price option. Thus, a state that has three crops eligible for RA coverage, such as Minnesota, will have 8 sets of

coefficients: two for a corn-soybean whole-farm unit, two for a corn-wheat whole-farm unit, two for a soybean-wheat whole-farm unit, and two for a corn-soybean-wheat whole-farm unit. There are eight sets each for Southern Minnesota, Northern Minnesota, Eastern South Dakota, and Western South Dakota. There are two sets of coefficients for states with two crops eligible for RA coverage, which includes Iowa, Illinois, Indiana, and Idaho. For North Dakota, which has six crops eligible for RA coverage, there are a total of 114 sets of whole-farm rating coefficients. The 162 sets of whole-farm coefficients are given in an Excel spreadsheet that accompanies these programming instructions.

There are six additional rating factors used to calculate whole-farm rates. These are *perlia*(*j*), which is calculated as

$$(22) \qquad perlia(j) = \frac{minrev(j)\sum_{i=1}^{N_j} acre(j,i)share(j,i)}{\sum_{j=1}^{6} minrev(j)\sum_{i=1}^{N_j} acre(j,i)share(j,i)} \quad j = c,s,w,cn,sf,b.$$

perlia should be rounded to four digits. If a crop is not grown, then set *minrev* for that crop equal to zero in this equation.

Whole-farm base premium rate

Table 1. Whole-farm rating coefficients and rating factors (variables).

Coefficient	Variable
betawf(0)	1.0
betawf(1)	erate(c)
betawf(2)	erate(s)
betawf(3)	erate(w)
betawf(4)	erate(cn)
betawf(5)	erate(sf)
betawf(6)	erate(b)
betawf(7)	erate(c)^2
betawf(8)	erate(s)^2
betawf(9)	erate(w)^2
betawf(10)	erate(cn)^2
betawf(11)	erate(sf)^2
betawf(12)	erate(b)^2
betawf(13)	erate(c) x erate(s)
betawf(14)	erate(c) x erate(w)
betawf(15)	erate(c) x erate(cn)
betawf(16)	erate(c) x erate(sf)
betawf(17)	erate(c) x erate(b)
betawf(18)	erate(s) x erate(w)
betawf(19)	erate(s) x erate(cn)

betawf(20) erate(s) x erate(sf)
betawf(21) erate(s) x erate(b)
betawf(22) erate(w) x erate(cn)
betawf(23) erate(w) x erate(sf)
betawf(24) erate(w) x erate(b)
betawf(25) erate(cn) x erate(sf)
betawf(26) erate(cn) x erate(b)
betawf(27) erate(sf) x erate(b)
betawf(28) covwf
betawf(29) $covwf^2$
betawf(30) covwf x erate(c)
betawf(31) covwf x erate(s)
betawf(32) covwf x erate(w)
betawf(33) covwf x erate(cn)
betawf(34) covwf x erate(sf)
betawf(35) covwf x erate(b)
betawf(36) perlia(c)
betawf(37) perlia(s)
betawf(38) perlia(w)
betawf(39) perlia(cn)
betawf(40) perlia(sf)
betawf(41) perlia(b)
betawf(42) $perlia(c)^2$
betawf(43) $perlia(s)^2$
betawf(44) $perlia(w)^2$
betawf(45) $perlia(cn)^2$
betawf(46) $perlia(sf)^2$
betawf(47) $perlia(b)^2$
betawf(48) $perlia(c)^3$
betawf(49) $perlia(s)^3$
betawf(50) $perlia(w)^3$
betawf(51) $perlia(cn)^3$
betawf(52) $perlia(sf)^3$
betawf(53) $perlia(b)^3$
betawf(54) perlia(c) x erate(c)
betawf(55) perlia(c) x erate(s)
betawf(56) perlia(c) x erate(w)
betawf(57) perlia(c) x erate(cn)
betawf(58) perlia(c) x erate(sf)
betawf(59) perlia(c) x erate(b)
betawf(60) perlia(s) x erate(c)
betawf(61) perlia(s) x erate(s)
betawf(62) perlia(s) x erate(w)
betawf(63) perlia(s) x erate(cn)

betawf(64) perlia(s) x erate(sf)
betawf(65) perlia(s) x erate(b)
betawf(66) perlia(w) x erate(c)
betawf(67) perlia(w) x erate(s)
betawf(68) perlia(w) x erate(w)
betawf(69) perlia(w) x erate(cn)
betawf(70) perlia(w) x erate(sf)
betawf(71) perlia(w) x erate(b)
betawf(72) perlia(cn) x erate(c)
betawf(73) perlia(cn) x erate(s)
betawf(74) perlia(cn) x erate(w)
betawf(75) perlia(cn) x erate(cn)
betawf(76) perlia(cn) x erate(sf)
betawf(77) perlia(cn) x erate(b)
betawf(78) perlia(sf) x erate(c)
betawf(79) perlia(sf) x erate(s)
betawf(80) perlia(sf) x erate(w)
betawf(81) perlia(sf) x erate(cn)
betawf(82) perlia(sf) x erate(sf)
betawf(83) perlia(sf) x erate(b)
betawf(84) perlia(b) x erate(c)
betawf(85) perlia(b) x erate(s)
betawf(86) perlia(b) x erate(w)
betawf(87) perlia(b) x erate(cn)
betawf(88) perlia(b) x erate(sf)
betawf(89) perlia(b) x erate(b)
betawf(90) perlia(c)^2 x erate(c)
betawf(91) perlia(c)^2 x erate(s)
betawf(92) perlia(c)^2 x erate(w)
betawf(93) perlia(c)^2 x erate(cn)
betawf(94) perlia(c)^2 x erate(sf)
betawf(95) perlia(c)^2 x erate(b)
betawf(96) perlia(s)^2 x erate(c)
betawf(97) perlia(s)^2 x erate(s)
betawf(98) perlia(s)^2 x erate(w)
betawf(99) perlia(s)^2 x erate(cn)
betawf(100) perlia(s)^2 x erate(sf)
betawf(101) perlia(s)^2 x erate(b)
betawf(102) perlia(w)^2 x erate(c)
betawf(103) perlia(w)^2 x erate(s)
betawf(104) perlia(w)^2 x erate(w)
betawf(105) perlia(w)^2 x erate(cn)
betawf(106) perlia(w)^2 x erate(sf)
betawf(107) perlia(w)^2 x erate(b)

betawf(108) perlia(cn)^2 x erate(c)
betawf(109) perlia(cn)^2 x erate(s)
betawf(110) perlia(cn)^2 x erate(w)
betawf(111) perlia(cn)^2 x erate(cn)
betawf(112) perlia(cn)^2 x erate(sf)
betawf(113) perlia(cn)^2 x erate(b)
betawf(114) perlia(sf)^2 x erate(c)
betawf(115) perlia(sf)^2 x erate(s)
betawf(116) perlia(sf)^2 x erate(w)
betawf(117) perlia(sf)^2 x erate(cn)
betawf(118) perlia(sf)^2 x erate(sf)
betawf(119) perlia(sf)^2 x erate(b)
betawf(120) perlia(b)^2 x erate(c)
betawf(121) perlia(b)^2 x erate(s)
betawf(122) perlia(b)^2 x erate(w)
betawf(123) perlia(b)^2 x erate(cn)
betawf(124) perlia(b)^2 x erate(sf)
betawf(125) perlia(b)^2 x erate(b)
betawf(126) perlia(c)^2 x covwf
betawf(127) perlia(s)^2 x covwf
betawf(128) perlia(w)^2 x covwf
betawf(129) perlia(cn)^2 x covwf
betawf(130) perlia(sf)^2 x covwf
betawf(131) perlia(b)^2 x covwf
betawf(132) perlia(c)^3 x covwf
betawf(133) perlia(s)^3 x covwf
betawf(134) perlia(w)^3 x covwf
betawf(135) perlia(cn)^3 x covwf
betawf(136) perlia(sf)^3 x covwf
betawf(137) perlia(b)^3 x covwf
betawf(138) efyld(c)/yldR05(c)
betawf(139) efyld(s)/yldR05(s)
betawf(140) efyld(w)/yldR05(w)
betawf(141) efyld(cn)/yldR05(cn)
betawf(142) efyld(sf)/yldR05(sf)
betawf(143) efyld(b)/yldR05(b)
betawf(144) (efyld(c)/yldR05(c))^2
betawf(145) (efyld(s)/yldR05(s))^2
betawf(146) (efyld(w)/yldR05(w))^2
betawf(147) (efyld(cn)/yldR05(cn))^2
betawf(148) (efyld(sf)/yldR05(sf))^2
betawf(149) (efyld(b)/yldR05(b))^2
betawf(150) perlia(c)/perlia(s)
betawf(151) perlia(c)/perlia(w)

betawf(152) perlia(c)/perlia(cn)
betawf(153) perlia(c)/perlia(sf)
betawf(154) perlia(c)/perlia(b)
betawf(155) perlia(s)/perlia(w)
betawf(156) perlia(s)/perlia(cn)
betawf(157) perlia(s)/perlia(sf)
betawf(158) perlia(s)/perlia(b)
betawf(159) perlia(w)/perlia(cn)
betawf(160) perlia(w)/perlia(sf)
betawf(161) perlia(w)/perlia(b)
betawf(162) perlia(cn)/perlia(sf)
betawf(163) perlia(cn)/perlia(b)
betawf(164) perlia(sf)/perlia(b)
betawf(165) $(\text{perlia(c)/perlia(s)})^2$
betawf(166) $((\text{perlia(c)/perlia(w)})^2$
betawf(167) $(\text{perlia(c)/perlia(cn)})^2$
betawf(168) $(\text{perlia(c)/perlia(sf)})^2$
betawf(169) $(\text{perlia(c)/perlia(b)})^2$
betawf(170) $(\text{perlia(s)/perlia(w)})^2$
betawf(171) $(\text{perlia(s)/perlia(cn)})^2$
betawf(172) $(\text{perlia(s)/perlia(sf)})^2$
betawf(173) $(\text{perlia(s)/perlia(b)})^2$
betawf(174) $(\text{perlia(w)/perlia(cn)})^2$
betawf(175) $(\text{perlia(w)/perlia(sf)})^2$
betawf(176) $(\text{perlia(w)/perlia(b)})^2$
betawf(177) $(\text{perlia(cn)/perlia(sf)})^2$
betawf(178) $(\text{perlia(cn)/perlia(b)})^2$
betawf(179) $(\text{perlia(sf)/perlia(b)})^2$
betawf(180) cvp(c)
betawf(181) cvp(s)
betawf(182) cvp(w)
betawf(183) cvp(cn)
betawf(184) cvp(sf)
betawf(185) cvp(b)
betawf(186) cvp(c)^2
betawf(187) cvp(s)^2
betawf(188) cvp(w)^2
betawf(189) cvp(cn)^2
betawf(190) cvp(sf)^2
betawf(191) cvp(b)^2
betawf(192) cvp(c) x erate(c)
betawf(193) cvp(c) x erate(s)
betawf(194) cvp(c) x erate(w)
betawf(195) cvp(c) x erate(cn)

betawf(196) cvp(c) x erate(sf)
betawf(197) cvp(c) x erate(b)
betawf(198) cvp(s) x erate(c)
betawf(199) cvp(s) x erate(s)
betawf(200) cvp(s) x erate(w)
betawf(201) cvp(s) x erate(cn)
betawf(202) cvp(s) x erate(sf)
betawf(203) cvp(s) x erate(b)
betawf(204) cvp(w) x erate(c)
betawf(205) cvp(w) x erate(s)
betawf(206) cvp(w) x erate(w)
betawf(207) cvp(w) x erate(cn)
betawf(208) cvp(w) x erate(sf)
betawf(209) cvp(w) x erate(b)
betawf(210) cvp(cn) x erate(c)
betawf(211) cvp(cn) x erate(s)
betawf(212) cvp(cn) x erate(w)
betawf(213) cvp(cn) x erate(cn)
betawf(214) cvp(cn) x erate(sf)
betawf(215) cvp(cn) x erate(b)
betawf(216) cvp(sf) x erate(c)
betawf(217) cvp(sf) x erate(s)
betawf(218) cvp(sf) x erate(w)
betawf(219) cvp(sf) x erate(cn)
betawf(220) cvp(sf) x erate(sf)
betawf(221) cvp(sf) x erate(b)
betawf(222) cvp(b) x erate(c)
betawf(223) cvp(b) x erate(s)
betawf(224) cvp(b) x erate(w)
betawf(225) cvp(b) x erate(cn)
betawf(226) cvp(b) x erate(sf)
betawf(227) cvp(b) x erate(b)
betawf(228) $cvp(c)^2$ x erate(c)
betawf(229) $cvp(c)^2$ x erate(s)
betawf(230) $cvp(c)^2$ x erate(w)
betawf(231) $cvp(c)^2$ x erate(cn)
betawf(232) $cvp(c)^2$ x erate(sf)
betawf(233) $cvp(c)^2$ x erate(b)
betawf(234) $cvp(s)^2$ x erate(c)
betawf(235) $cvp(s)^2$ x erate(s)
betawf(236) $cvp(s)^2$ x erate(w)
betawf(237) $cvp(s)^2$ x erate(cn)
betawf(238) $cvp(s)^2$ x erate(sf)
betawf(239) $cvp(s)^2$ x erate(b)

betawf(240) cvp(w)^2 x erate(c)
betawf(241) cvp(w)^2 x erate(s)
betawf(242) cvp(w)^2 x erate(w)
betawf(243) cvp(w)^2 x erate(cn)
betawf(244) cvp(w)^2 x erate(sf)
betawf(245) cvp(w)^2 x erate(b)
betawf(246) cvp(cn)^2 x erate(c)
betawf(247) cvp(cn)^2 x erate(s)
betawf(248) cvp(cn)^2 x erate(w)
betawf(249) cvp(cn)^2 x erate(cn)
betawf(250) cvp(cn)^2 x erate(sf)
betawf(251) cvp(cn)^2 x erate(b)
betawf(252) cvp(sf)^2 x erate(c)
betawf(253) cvp(sf)^2 x erate(s)
betawf(254) cvp(sf)^2 x erate(w)
betawf(255) cvp(sf)^2 x erate(cn)
betawf(256) cvp(sf)^2 x erate(sf)
betawf(257) cvp(sf)^2 x erate(b)
betawf(258) cvp(b)^2 x erate(c)
betawf(259) cvp(b)^2 x erate(s)
betawf(260) cvp(b)^2 x erate(w)
betawf(261) cvp(b)^2 x erate(cn)
betawf(262) cvp(b)^2 x erate(sf)
betawf(263) cvp(b)^2 x erate(b)
betawf(264) perlia(c) x cvp(c)
betawf(265) perlia(c) x cvp(s)
betawf(266) perlia(c) x cvp(w)
betawf(267) perlia(c) x cvp(cn)
betawf(268) perlia(c) x cvp(sf)
betawf(269) perlia(c) x cvp(b)
betawf(270) perlia(s) x cvp(c)
betawf(271) perlia(s) x cvp(s)
betawf(272) perlia(s) x cvp(w)
betawf(273) perlia(s) x cvp(cn)
betawf(274) perlia(s) x cvp(sf)
betawf(275) perlia(s) x cvp(b)
betawf(276) perlia(w) x cvp(c)
betawf(277) perlia(w) x cvp(s)
betawf(278) perlia(w) x cvp(w)
betawf(279) perlia(w) x cvp(cn)
betawf(280) perlia(w) x cvp(sf)
betawf(281) perlia(w) x cvp(b)
betawf(282) perlia(cn) x cvp(c)
betawf(283) perlia(cn) x cvp(s)

betawf(284) perlia(cn) x cvp(w)
betawf(285) perlia(cn) x cvp(cn)
betawf(286) perlia(cn) x cvp(sf)
betawf(287) perlia(cn) x cvp(b)
betawf(288) perlia(sf) x cvp(c)
betawf(289) perlia(sf) x cvp(s)
betawf(290) perlia(sf) x cvp(w)
betawf(291) perlia(sf) x cvp(cn)
betawf(292) perlia(sf) x cvp(sf)
betawf(293) perlia(sf) x cvp(b)
betawf(294) perlia(c)^2 x cvp(c)
betawf(295) perlia(c)^2 x cvp(s)
betawf(296) perlia(c)^2 x cvp(w)
betawf(297) perlia(c)^2 x cvp(cn)
betawf(298) perlia(c)^2 x cvp(sf)
betawf(299) perlia(c)^2 x cvp(b)
betawf(300) perlia(s)^2 x cvp(c)
betawf(301) perlia(s)^2 x cvp(s)
betawf(302) perlia(s)^2 x cvp(w)
betawf(303) perlia(s)^2 x cvp(cn)
betawf(304) perlia(s)^2 x cvp(sf)
betawf(305) perlia(s)^2 x cvp(b)
betawf(306) perlia(w)^2 x cvp(c)
betawf(307) perlia(w)^2 x cvp(s)
betawf(308) perlia(w)^2 x cvp(w)
betawf(309) perlia(w)^2 x cvp(cn)
betawf(310) perlia(w)^2 x cvp(sf)
betawf(311) perlia(w)^2 x cvp(b)
betawf(312) perlia(cn)^2 x cvp(c)
betawf(313) perlia(cn)^2 x cvp(s)
betawf(314) perlia(cn)^2 x cvp(w)
betawf(315) perlia(cn)^2 x cvp(cn)
betawf(316) perlia(cn)^2 x cvp(sf)
betawf(317) perlia(cn)^2 x cvp(b)
betawf(318) perlia(sf)^2 x cvp(c)
betawf(319) perlia(sf)^2 x cvp(s)
betawf(320) perlia(sf)^2 x cvp(w)
betawf(321) perlia(sf)^2 x cvp(cn)
betawf(322) perlia(sf)^2 x cvp(sf)
betawf(323) perlia(sf)^2 x cvp(b)
betawf(324) perlia(b)^2 x cvp(c)
betawf(325) perlia(b)^2 x cvp(s)
betawf(326) perlia(b)^2 x cvp(w)
betawf(327) perlia(b)^2 x cvp(cn)

betawf(328) perlia(b)^2 x cvp(sf)
betawf(329) perlia(b)^2 x cvp(b)

The whole-farm premium rate (*wfpremr*) is found by multiplying each coefficient by the corresponding value of the variable and then summing the results. Each individual calculation should be rounded to 9 digits. The sum should be rounded to 4 digits. If a crop is not used, care must be taken to avoid divide-by-zero errors in the rating variables.

Checking to See if Maximum Whole-Farm Discount is Exceeded

RA whole-farm premium rates cannot be less than *minratefactor* times the average premium rate had the producer bought enterprise unit coverage, where *minratefactor* = .5, if two crops are included in the whole-farm unit, = .475 if three crops, = .45 if four crops, = .425 if five crops, and = .4 if six crops are include. To determine if this limit has been exceeded we need to use the whole-farm coverage level, *covwf*, in the enterprise unit premium equations for the crops in the whole-farm unit. The enterprise equations with *covwf* is reproduced below. Each individual calculation is rounded to 9 digits to the right of the decimal place, and the variable *epremrw* is rounded to 4 digits. *epremrw*(*j*) is rounded to four digits.

(23)

$$\begin{aligned} epremrw(j) &= \text{beta}(j,0) + \text{beta}(j,1)erate(j) + \text{beta}(j,2)erate(j)^2 + \text{beta}(j,3)covwf \\ &+ \text{beta}(j,4)covwf^2 + \text{beta}(j,5)\frac{efyld(j)}{yldR05(j)} + \text{beta}(j,6)\left(\frac{efyld(j)}{yldR05(j)}\right)^2 + \text{beta}(j,7)cvp(j) \\ &+ \text{beta}(j,8)cvp(j)^2 + \text{beta}(j,9)erate(j)\cdot covwf + \text{beta}(j,10)erate(j)\cdot\frac{efyld(j)}{yldR05(j)} \\ &+ \text{beta}(j,11)erate(j)\cdot cvp(j) + \text{betac}(j,12)covwf\cdot\frac{efyld(j)}{yldR05(j)} \\ &+ \text{betac}(j,13)covwf\cdot cvp(j) + \text{beta}(j,14)\cdot\frac{efyld(j)}{yldR05(j)}\cdot cvp(j), j = c,s,w,cn,sf,b. \end{aligned}$$

Now we need to take the weighted average of *epremrw* to determine if the maximum discount has been exceeded.

(24)
$$wfpremre = \frac{\sum_{j=c,s,w,cn,sf,b}\left(\sum_{i=i}^{N(j)}\text{round}(epremrw(j)\cdot acre(j,i)share(j,i),0)\right)}{\left(\sum_{j=c,s,w,cn,sf,b}\sum_{i=i}^{N(j)}acre(j,i)share(j,i)\right.}$$

Now set *wfpremr* equal to *minratefactor* times the weighted average of the enterprise unit premium rate if the maximum discount is exceeded, otherwise leave it

alone. The product of *minratefactor* times the weighted average of the enterprise unit premium rate is rounded to four digits before the comparison is done.

(25) $wfpremr = \max(wfpremr, \text{round}(minratefactor \cdot wfpremre),4)$

Per-acre whole-farm unit premiums

The next step is to add the prevented planting load. The resulting per-acre premium is rounded to two digits. The prevented planting load is the share and acreage weighted average of the prevented planting load for corn and soybeans.

At 60% prevented planting

(26) $LWFP = wfpremr \cdot revwf$

At 65% prevented planting

(27)

$$LWFP = wfpremr \cdot revwf \cdot \frac{\sum_{j=c,s,w,cn,sf,b} PP65(j)(\sum_{i=i}^{N(j)} acre(j,i)share(j,i))}{\sum_{j=c,s,w,cn,sf,b} \sum_{i=i}^{N(j)} acre(j,i)share(j,i)}$$

At 70% prevented planting

(28)

$$LWFP = wfpremr \cdot revwf \cdot \frac{\sum_{j=c,s,w,cn,sf,b} PP70(j)(\sum_{i=i}^{N(j)} acre(j,i)share(j,i))}{\sum_{j=c,s,w,cn,sf,b} \sum_{i=i}^{N(j)} acre(j,i)share(j,i)}$$

Total whole-farm unit premiums

Total loaded premium is then found by multiplying *LWFP* by insured acres on each unit (or record) and then summing up over all records. **Rounding on a record by record basis is a major change for RA 2000 (M13, rectype 11, field 43, Total Premium, pos.222). This change will remove the need for proration for DAS.**

(29) $$TLWFP = \sum_{j=c,s,w,cn,sf,b} \sum_{i=i}^{N(j)} round(LWFP \cdot acre(j,i) \cdot share(j,i),0)$$

7. Premium Subsidy

The premium subsidy cannot exceed the premium subsidy available had the farmer purchased a comparable APH policy. All premium subsidies are rounded to whole-dollar amounts.

The variable *ppfact*(*j*) is the prevented planting factor for crop *j*. If the farmer does not buy up prevented planting coverage then *ppfact*(*j*) = 1.

Optional units

First calculate the subsidy available under a comparable APH policy. One rounding rule has to be followed in this calculation. The product of approved yield and 0.65 is rounded to one digit to the right of the decimal.

(30) $$subaphou(j,i) = 0.417 \cdot \text{round}[\text{round}(0.65 \cdot fyld(j,i),1) \cdot rateou(j,i) \cdot APHp(j) \; share(j,i) \cdot ppfact(j) \cdot acre(j,i) \cdot psurc(j,i),0] \quad i = 1,\ldots,N(j); j = c,s,w,cn,sf,b$$

$psurc = 1.05$ if $fyld(j,i)$ is cupped, else $psurc = 1.0$

The RA premium subsidy equals the minimum of an RA subsidy factor times the total loaded RA premium and the subsidy available under a comparable APH policy.

(31) $$psubou(j,i) = \min(subaphou(j,i), \text{round}(subfact(j) \cdot TLP(j,i),0)), \quad i = 1,\ldots,N(j); \; j = c,s,w,cn,sf,b.$$

where

(32) $$subfact(j) = 3.7074 - 7.90314 \cdot cover(j) + 4.371429 \cdot cover(j)^2$$

subfact(j) is rounded to three digits.

Basic units

First calculate the subsidy available under a comparable APH policy.

(33) $$subaphb(j,i) = 0.417 \cdot \text{round}[\text{round}(0.65 \cdot fyld(j,i),1) \cdot rate(j,i) \cdot APHp(j) \cdot share(j,i) \cdot ppfact(j) \cdot acre(j,i) \cdot psurc(j,i),0] \quad i = 1,\ldots,N(j); j = c,s,w,cn,sf,b$$

subaphb(j,i) is rounded to whole dollar amounts.

psurc = 1.05 if *fyld*(*j*,*i*) is cupped, else *psurc* = 1.0

(34) $$psubb(j,i) = \min(subaphb(j,i), \text{round}[subfact(j) \cdot TLP(j,i),0]), \quad i = 1,\ldots,N(j); \; j = c,s,w,cn,sf,b.$$

Enterprise unit

First calculate the premium subsidy available had the farmer purchased APH basic units.

(35) $$subaphe(j) = \sum_{i=1}^{N(j)} subaphb(j,i), j = c,s,w,cn,sf,b$$

Now calculate the premium subsidy for RA using the RA premium subsidy factor for enterprise units. This premium subsidy is calculated on a record by record basis, and then summed. Note that the record premium needs to be rounded before it is multiplied by the RA premium subsidy factor.

(36) $$psube(j) = \sum_{i=1}^{N(j)} \text{round}(subfacte(j) \cdot \text{round}(LEP(j) \cdot acre(j,i) \cdot share(j,i)),0),0)), \quad j = c,s,w,cn,sf,b$$

where

(37) $$subfacte(j) = 3.7074 - 7.90314 \cdot covere(j) + 4.371429 \cdot covere(j)^2$$

subfacte(j) is rounded to three digits.

The final step is to compare *subaphe(j)* and *psube(j)*. If *subaphe(j)* is less than *psube(j)*, then *subaphb(j,i)* is used to calculate producer premium on a record by record basis. If *subaphe(j)* is greater than *psube(j)*, then the quantity round(*subfacte*(*j*) round(*LEP(j) acre(j,i) share(j,i)*),0),0) is used to calculate producer premium on a record by record basis. **This is a major change for RA in 2000**.

Whole-farm unit

First calculate the premium subsidy available had the farmer purchased APH basic units.

(38) $$subaphwf = subaphe(c) + subaphe(s) + subaphe(w) + subaphe(cn) + subaphe(sf) + subaphe(b)$$

Now calculate the premium subsidy for RA using the RA premium subsidy factor for whole-farm units. This premium subsidy is calculated on a record by record basis, and then summed. Note that the record premium needs to be rounded before it is multiplied by the RA premium subsidy factor.

(39)

$$psubwf = \sum_{c,s,w,cn,sf,b} \sum_{i=1}^{N(j)} \text{round}(subfactwf \cdot round(LWFP \cdot acre(j,i) \cdot share(j,i)),0),0)),$$

where

(40)

$$subfactwf = 3.7074 - 7.90314 \cdot covwf + 4.371429 \cdot covwf^2$$

subfactwf is rounded to three digits.

The final step is to compare *subaphwf* and *psubwf*. If *subaphwf* is less than *psubwf*, then *subaphb(j,i)* is used to calculate producer premium on a record by record basis. If *subaphwf* is greater than *psubwf*, then the quantity round(*subfactwf* round(*LWFP acre(j,i) share(j,i)*),0),0) is used to calculate producer premium on a record by record basis. **This is a major change for RA in 2000**.

8. Producer Paid Premiums

The following equations are used to calculate the subsidized producer-paid premiums for each unit structure. Because both the unsubsidized and subsidized premiums are rounded to whole-dollar amounts, there will be no need to round producer paid premium.

Optional units

(41) $$TLPsub(j,i) = TLP(j,i) - psubou(j,i), i = 1,\ldots,N(j);\ j = c,s,w,cn,sf,b.$$

Basic units

(42) $$TLPsub(j,i) = TLP(j,i) - psubb(j,i), i = 1,\ldots,N(j); j = c,s,w,cn,sf,b.$$

Enterprise unit

If *subaphe(j)* is less than *psube(j)*, then

(43) $$TLEPsub(j,i) = \text{round}(LEP(j) \cdot acre(j,i) \cdot share(j,i)),0) - subaphb(j,i)$$
$$i = 1,...,N(j);\ j = c,s,w,cn,,sf,b.$$

If *subaphe(j)* is greater than *psube(j)*, then

(44) $$TLEPsub(j,i) = \text{round}(LEP(j) \cdot acre(j,i) \cdot share(j,i)),0) - \text{round}(subfacte(j) \cdot \text{round}(LEP(j) \cdot acre(j,i) \cdot share(j,i)),0),0)$$
$$i = 1,...,N(j);\ j = c,s,w,cn,,sf,b.$$

Whole-farm unit

If *subaphwf* is less than *psubwf*, then

(45) $$TLWFPsub(j,i) = \text{round}(LWFP \cdot acre(j,i) \cdot share(j,i)),0) - subaphb(j,i)$$
$$i = 1,...,N(j);\ j = c,s,w,cn,,sf,b.$$

If *subaphwf* is greater than *psubwf*, then

(46) $$TLWFPsub(j,i) = \text{round}(LWFP(j) \cdot acre(j,i) \cdot share(j,i)),0) - \text{round}(subfactwf(j) \cdot \text{round}(LWFP(j) \cdot acre(j,i) \cdot share(j,i)),0),0)$$
$$i = 1,...,N(j);\ j = c,s,w,cn,,sf,b.$$

9. Appendix A. Coefficient Values for Single-Crop Equations

In 2000, Iowa, Illinois and Indiana will have two crops eligible for RA. Idaho, Minnesota, and South Dakota will have three crops eligible, and North Dakota will have six crops eligible. The single crop coefficients are presented in the tables below by state.

Because there are 162 sets of whole-farm coefficients, with each set containing 330 coefficients, it is not practical or useful to print them here. An Excel spreadsheet containing the coefficients will accompany this set of programming instructions.

In the tables "Option = No" refers to the single-crop coefficients that are used when the producer does not select the harvest price option. "Option = Yes" refers to the coefficients that should be used when the producer selects the harvest price option.

Table A1. Single crop coefficients for Idaho

	Idaho					
	Spring Wheat		**Canola**		**Barley**	
	Option = no	**Option= yes**	**Option = no**	**Option= yes**	**Option = no**	**Option = yes**
beta(0)	-0.16438	-0.18153	-0.10462	-0.11482	-0.17617	-0.19215
beta(1)	1.16484	1.27202	0.85411	0.90925	1.16531	1.27182
beta(2)	-0.09224	-0.21328	0.32175	0.28752	-0.06103	-0.17964
beta(3)	0.19383	0.21510	0.17778	0.18946	0.22941	0.24402
beta(4)	0.09381	0.10305	0.10307	0.11978	0.07367	0.08842
beta(5)	0.02243	0.02167	-0.03651	-0.04013	0.02269	0.02284
beta(6)	0.00589	0.00857	0.02067	0.02552	0.00576	0.00846
beta(7)	-0.04773	-0.07876	-0.09278	-0.12737	-0.04645	-0.07090
beta(8)	0.18443	0.09931	0.24975	0.16242	0.21208	0.12710
beta(9)	-0.16172	-0.26359	-0.22610	-0.33616	-0.20586	-0.30221
beta(10)	0.02672	0.03981	0.27996	0.34279	0.03219	0.04502
beta(11)	-0.28855	0.14838	-0.27545	0.13882	-0.28872	0.12685
beta(12)	-0.06259	-0.07363	-0.05886	-0.07453	-0.06291	-0.07503
beta(13)	0.15720	0.31680	0.16425	0.34337	0.14875	0.30449
beta(14)	-0.00904	-0.02097	-0.00370	-0.02263	-0.00697	-0.01923

Table A2. Single crop coefficients for Illinois

	Illinois			
	Corn		Soybeans	
	Option = no	Option= yes	Option = no	Option = yes
beta(0)	-0.07727	-0.09442	-0.06656	-0.06977
beta(1)	0.75639	0.93959	0.8504	0.93357
beta(2)	-0.0884	-0.4903	-0.26828	-0.49726
beta(3)	0.02436	0.03687	-0.00799	-0.01597
beta(4)	0.15904	0.18536	0.18345	0.21383
beta(5)	0.0436	0.05058	0.04146	0.04204
beta(6)	0.00699	0.01177	0.00713	0.01194
beta(7)	-0.20604	-0.27185	-0.20476	-0.26378
beta(8)	0.27356	0.20349	0.29236	0.22149
beta(9)	0.36872	0.20055	0.26516	0.16684
beta(10)	0.06642	0.10423	0.07627	0.13431
beta(11)	-0.17556	0.5512	-0.2168	0.40216
beta(12)	-0.08962	-0.11846	-0.08602	-0.10699
beta(13)	0.24246	0.47143	0.28686	0.49078
beta(14)	-0.01249	-0.02682	-0.02219	-0.03377

Table A3. Single crop coefficients for Indiana

	Indiana			
	Corn		Soybeans	
	Option = no	Option= yes	Option = no	Option = yes
beta(0)	-0.10367	-0.14428	-0.15509	-0.14798
beta(1)	1.0863	1.37339	1.34321	1.73541
beta(2)	-0.05144	-0.43752	-0.29803	-0.41544
beta(3)	0.05027	0.11261	0.14471	0.19257
beta(4)	0.18668	0.18961	0.13708	0.07989
beta(5)	0.04487	0.05142	0.05481	0.03561
beta(6)	0.00834	0.01388	0.00518	0.00975
beta(7)	-0.25136	-0.3159	-0.19741	-0.79864
beta(8)	0.3087	0.23568	0.32346	1.31838
beta(9)	-0.07656	-0.37215	-0.21614	-0.50795
beta(10)	0.04027	0.07144	-0.07401	-0.10912
beta(11)	-0.23018	0.4199	-0.32096	-0.50699
beta(12)	-0.10144	-0.13259	-0.09779	-0.09255
beta(13)	0.27958	0.53236	0.26542	0.9701
beta(14)	-0.00306	-0.02335	-0.01188	-0.00236

Table A4. Single crop coefficients for Iowa

	Iowa			
	Corn		Soybeans	
	Option = no	Option= yes	Option = no	Option= yes
beta(0)	-0.06702	-0.08801	-0.06226	-0.06538
beta(1)	0.71182	0.93041	0.82289	0.91853
beta(2)	-0.05698	-0.52708	-0.24116	-0.50253
beta(3)	0.00038	0.02156	-0.01620	-0.02421
beta(4)	0.17031	0.19398	0.18585	0.21708
beta(5)	0.04712	0.05276	0.04308	0.04227
beta(6)	0.00591	0.01144	0.00669	0.01186
beta(7)	-0.22933	-0.29776	-0.21835	-0.27985
beta(8)	0.27952	0.20792	0.29876	0.22650
beta(9)	0.43886	0.22308	0.30167	0.18437
beta(10)	0.04572	0.10047	0.06784	0.13641
beta(11)	-0.12068	0.67906	-0.19416	0.46235
beta(12)	-0.08980	-0.12015	-0.08623	-0.10689
beta(13)	0.22556	0.48291	0.28282	0.50117
beta(14)	-0.00652	-0.02300	-0.01967	-0.03281

Table A5. Single crop coefficients for Southern Minnesota

	Southern Minnesota					
	Corn		Soybeans		Spring Wheat	
	Option = no	Option= yes	Option = no	Option= yes	Option = no	Option= yes
beta(0)	-0.07727	-0.09442	-0.06656	-0.06977	-0.23971	-0.27507
beta(1)	0.75639	0.93959	0.85040	0.93357	1.12808	1.22164
beta(2)	-0.08840	-0.49030	-0.26828	-0.49726	0.01797	-0.06587
beta(3)	0.02436	0.03687	-0.00799	-0.01597	0.40034	0.46867
beta(4)	0.15904	0.18536	0.18345	0.21383	-0.03801	-0.05780
beta(5)	0.04360	0.05058	0.04146	0.04204	0.02944	0.02927
beta(6)	0.00699	0.01177	0.00713	0.01194	0.00361	0.00583
beta(7)	-0.20604	-0.27185	-0.20476	-0.26378	-0.07494	-0.08117
beta(8)	0.27356	0.20349	0.29236	0.22149	0.21342	0.12744
beta(9)	0.36872	0.20055	0.26516	0.16684	-0.20224	-0.29733
beta(10)	0.06642	0.10423	0.07627	0.13431	0.03889	0.05186
beta(11)	-0.17556	0.55120	-0.21680	0.40216	-0.25274	0.15356
beta(12)	-0.08962	-0.11846	-0.08602	-0.10699	-0.06473	-0.07620
beta(13)	0.24246	0.47143	0.28686	0.49078	0.16125	0.30754
beta(14)	-0.01249	-0.02682	-0.02219	-0.03377	-0.01157	-0.02347

Table A6. Single crop coefficients for Northern Minnesota

	Northern Minnesota					
	Corn		Soybeans		Spring Wheat	
	Option = no	Option= yes	Option = no	Option= yes	Option = no	Option= yes
beta(0)	-0.21513	-0.23732	-0.23300	-0.22804	-0.21139	-0.26570
beta(1)	1.19244	1.28396	1.17269	1.35975	1.06216	1.18708
beta(2)	0.09248	0.02174	0.13426	0.10208	0.05716	-0.05504
beta(3)	0.35187	0.38620	0.28580	0.29324	0.34137	0.45991
beta(4)	0.00673	0.00854	0.08557	0.08015	-0.00971	-0.05929
beta(5)	0.01335	0.01124	0.08236	0.06703	0.03279	0.02836
beta(6)	0.00773	0.01059	-0.00700	0.00131	0.00317	0.00616
beta(7)	-0.07962	-0.08878	-0.03268	-0.35424	-0.18472	-0.16935
beta(8)	0.22169	0.15085	0.19315	1.02786	0.25085	0.15286
beta(9)	-0.36421	-0.46038	-0.35889	-0.52127	-0.13502	-0.27016
beta(10)	0.05818	0.07543	0.07330	0.08087	0.03950	0.06543
beta(11)	-0.24464	0.11580	-0.25849	-0.33084	-0.11327	0.34380
beta(12)	-0.06441	-0.07462	-0.10712	-0.11154	-0.06720	-0.07791
beta(13)	0.17155	0.31866	0.13316	0.56064	0.20655	0.38706
beta(14)	-0.00810	-0.02466	-0.00563	-0.02737	-0.00672	-0.02022

Table A7. Single crop coefficients for Eastern South Dakota

	Eastern South Dakota					
	Corn		Soybeans		Spring Wheat	
	Option = no	Option= yes	Option = no	Option= yes	Option = no	Option= yes
beta(0)	-0.07727	-0.09442	-0.06656	-0.06977	-0.23971	-0.27507
beta(1)	0.75639	0.93959	0.85040	0.93357	1.12808	1.22164
beta(2)	-0.08840	-0.49030	-0.26828	-0.49726	0.01797	-0.06587
beta(3)	0.02436	0.03687	-0.00799	-0.01597	0.40034	0.46867
beta(4)	0.15904	0.18536	0.18345	0.21383	-0.03801	-0.05780
beta(5)	0.04360	0.05058	0.04146	0.04204	0.02944	0.02927
beta(6)	0.00699	0.01177	0.00713	0.01194	0.00361	0.00583
beta(7)	-0.20604	-0.27185	-0.20476	-0.26378	-0.07494	-0.08117
beta(8)	0.27356	0.20349	0.29236	0.22149	0.21342	0.12744
beta(9)	0.36872	0.20055	0.26516	0.16684	-0.20224	-0.29733
beta(10)	0.06642	0.10423	0.07627	0.13431	0.03889	0.05186
beta(11)	-0.17556	0.55120	-0.21680	0.40216	-0.25274	0.15356
beta(12)	-0.08962	-0.11846	-0.08602	-0.10699	-0.06473	-0.07620
beta(13)	0.24246	0.47143	0.28686	0.49078	0.16125	0.30754
beta(14)	-0.01249	-0.02682	-0.02219	-0.03377	-0.01157	-0.02347

Table A8. Single crop coefficients for Western South Dakota

	Western South Dakota					
	Corn		Soybeans		Spring Wheat	
	Option = no	Option= yes	Option = no	Option= yes	Option = no	Option= yes
beta(0)	-0.21513	-0.23732	-0.23300	-0.22804	-0.21139	-0.26570
beta(1)	1.19244	1.28396	1.17269	1.35975	1.06216	1.18708
beta(2)	0.09248	0.02174	0.13426	0.10208	0.05716	-0.05504
beta(3)	0.35187	0.38620	0.28580	0.29324	0.34137	0.45991
beta(4)	0.00673	0.00854	0.08557	0.08015	-0.00971	-0.05929
beta(5)	0.01335	0.01124	0.08236	0.06703	0.03279	0.02836
beta(6)	0.00773	0.01059	-0.00700	0.00131	0.00317	0.00616
beta(7)	-0.07962	-0.08878	-0.03268	-0.35424	-0.18472	-0.16935
beta(8)	0.22169	0.15085	0.19315	1.02786	0.25085	0.15286
beta(9)	-0.36421	-0.46038	-0.35889	-0.52127	-0.13502	-0.27016
beta(10)	0.05818	0.07543	0.07330	0.08087	0.03950	0.06543
beta(11)	-0.24464	0.11580	-0.25849	-0.33084	-0.11327	0.34380
beta(12)	-0.06441	-0.07462	-0.10712	-0.11154	-0.06720	-0.07791
beta(13)	0.17155	0.31866	0.13316	0.56064	0.20655	0.38706
beta(14)	-0.00810	-0.02466	-0.00563	-0.02737	-0.00672	-0.02022

Table A9. Minnesota counties that make up Southern Minnesota and South Dakota counties that make up Eastern South Dakota.

FIPS	Southern Minn	FIPS	E. South Dakota
27011	Big Stone	46009	Bon Homme
27013	Blue Earth	46011	Brookings
27015	Brown	46027	Clay
27019	Carver	46029	Codington
27023	Chippewa	46035	Davison
27033	Cottonwood	46039	Deuel
27037	Dakota	46051	Grant
27039	Dodge	46057	Hamlin
27041	Douglas	46061	Hanson
27043	Faribault	46067	Hutchinson
27045	Fillmore	46077	Kingsbury
27047	Freeborn	46079	Lake
27049	Goodhue	46083	Lincoln
27051	Grant	46087	McCook
27053	Hennepin	46097	Miner
27055	Houston	46099	Minnehaha
27063	Jackson	46101	Moody
27067	Kandiyohi	46111	Sanborn
27073	Lac Qui Parle	46125	Turner
27079	Le Sueur	46127	Union
27081	Lincoln	46135	Yankton
27083	Lyon		
27085	McLeod		
27091	Martin		
27093	Meeker		
27099	Mower		
27101	Murray		
27103	Nicollet		
27105	Nobles		
27109	Olmsted		
27117	Pipestone		
27121	Pope		
27127	Redwood		
27129	Renville		
27131	Rice		
27133	Rock		
27139	Scott		
27143	Sibley		
27145	Stearns		
27147	Steele		
27149	Stevens		
27151	Swift		

27155	**Traverse**
27157	**Wabasha**
27161	**Waseca**
27165	**Watonwan**
27169	**Winona**
27171	**Wright**
27173	**Yellow Medicine**

Table A10. Single Crop Coefficients for North Dakota

	North Dakota											
	Corn		Soybeans		Spring Wheat		Canola		Sunflower		Barley	
	Option = no	Option= yes	Option = no	Option= yes	Option = no	Option= yes	Option = no	Option= yes	Option = no	Option= yes	Option = no	Option= yes
beta(0)	-0.21513	-0.23732	-0.23300	-0.22804	-0.21139	-0.26570	-0.11674	-0.12366	-0.14527	-0.14171	-0.15972	-0.17375
beta(1)	1.19244	1.28396	1.17269	1.35975	1.06216	1.18708	0.87331	0.93147	1.01963	1.21031	1.19731	1.29198
beta(2)	0.09248	0.02174	0.13426	0.10208	0.05716	-0.05504	0.36130	0.32848	0.13267	0.10672	-0.10745	-0.19591
beta(3)	0.35187	0.38620	0.28580	0.29324	0.34137	0.45991	0.19218	0.19505	0.22325	0.25138	0.19871	0.20691
beta(4)	0.00673	0.00854	0.08557	0.08015	-0.00971	-0.05929	0.09799	0.11942	0.06927	0.03275	0.08492	0.10150
beta(5)	0.01335	0.01124	0.08236	0.06703	0.03279	0.02836	-0.01715	-0.01852	0.00502	-0.00465	0.01562	0.01920
beta(6)	0.00773	0.01059	-0.00700	0.00131	0.00317	0.00616	0.01901	0.02324	0.01172	0.01404	0.00410	0.00580
beta(7)	-0.07962	-0.08878	-0.03268	-0.35424	-0.18472	-0.16935	-0.08567	-0.12085	-0.10352	-0.50729	-0.08262	-0.12138
beta(8)	0.22169	0.15085	0.19315	1.02786	0.25085	0.15286	0.23418	0.16264	0.27406	1.15750	0.23761	0.14605
beta(9)	-0.36421	-0.46038	-0.35889	-0.52127	-0.13502	-0.27016	-0.23404	-0.34138	-0.22048	-0.37219	-0.21455	-0.31389
beta(10)	0.05818	0.07543	0.07330	0.08087	0.03950	0.06543	0.29411	0.35016	0.17347	0.16242	0.03589	0.05825
beta(11)	-0.24464	0.11580	-0.25849	-0.33084	-0.11327	0.34380	-0.27817	0.12366	-0.26200	-0.33023	-0.25983	0.17512
beta(12)	-0.06441	-0.07462	-0.10712	-0.11154	-0.06720	-0.07791	-0.07712	-0.09348	-0.06831	-0.06282	-0.04930	-0.06195
beta(13)	0.17155	0.31866	0.13316	0.56064	0.20655	0.38706	0.17917	0.35282	0.18721	0.67643	0.15142	0.32395
beta(14)	-0.00810	-0.02466	-0.00563	-0.02737	-0.00672	-0.02022	-0.01240	-0.03229	-0.01360	-0.02365	0.00097	-0.00964