Arizona's Answer

to the Las Vegas wheel of fortune

*by John Wildermuth and Russell Gum**

Everyone taking part in a game of chance is faced with risk and uncertainty regarding the outcome. The experienced gambler gains an advantage through careful scrutiny of the odds and due consideration to the laws of probability. So it is with farming.

There are a number of factors, for example weather, insects, and disease, which cause agricultural prices, yields, and subsequently incomes to vary in a random or unpredictable fashion. The experienced Arizona farmer considers these factors as he compares alternative enterprises and farm plans. However, experience itself is often limited to a small number of alternatives. Further, it may be based on a biased sample of unusual years. Thus, the purpose of this article is to provide an objective basis for an evaluation of the relative "riskiness" of a broad range of Arizona field crops.

Measurement of Risk

Variability measures for 23 field crops have been derived from Arizona state price and yield historical data.[1] Assuming that future variability for these crops is closely related to past variability, these estimates will serve as realistic measures of relative "riskiness." It must be remembered that for certain farms or areas within the state, the absolute variability for any given crop may be higher or lower depending upon specific climatic, resource, and economic conditions. Thus, while on an individual crop basis these estimates are in general somewhat optimistic, they should be reliable for between-crop comparisons.

Price Variability

The variability coefficient shows in percentage terms the degree of random or unpredictable variability relative to the current level of the item in question. Accordingly, the mean prices (average over the last five years) and the corresponding variability coefficients are presented in Table 1. The "Bad Year" figures should be interpreted to mean that at least one year in ten (10 percent probability of occurrence) the price will be this low or lower.

It is not worthwhile to discuss the ranking in terms of each individual crop. This would only duplicate what is obvious in Table 1. At this stage it suffices to say that in general the truck crops display much more price variability than do the standard field

Table 1. Ranking of Arizona Crops by Price Variability Coefficients.

Rank	*Crop*	*Units*	*Mean* (*price*)	*Var. Coeff.*	*Bad Year* (*price*)
1	**Barley**	$/cwt.	2.51	3.3	2.41
2	**Oats**	$/cwt.	3.05	3.4	2.92
3	**Corn**	$/cwt.	2.79	5.5	2.60
4	**Wheat**	$/cwt.	2.94	5.7	2.72
5	**Alfalfa Hay**	$/ton	27.88	5.9	25.70
6	**Grain Hay**	$/ton	25.90	6.3	23.82
7	**Winter Broccoli**	$/cwt.	12.86	7.7	11.59
8	**Alfalfa Seed**	$/cwt.	29.70	8.2	26.58
9	**Grain Sorghum**	$/cwt.	2.16	8.4	1.93
10	**Upland Cotton**	$/lb.	29.85	9.5	26.23
11	**Long Staple Cotton**	$/lb.	50.18	9.7	43.95
12	**Winter Cauliflower**	$/cwt.	12.38	11.8	10.51
13	**Winter Cabbage**	$/cwt.	3.82	16.1	3.04
14	**Summer Cantaloupes**	$/cwt.	7.72	16.2	6.12
15	**Winter Lettuce**	$/cwt.	4.78	16.4	3.77
16	**Carrots**	$/cwt.	4.78	16.9	3.74
17	**Honeydew Melons**	$/cwt.	6.94	20.1	5.14
18	**Early Summer Watermelons**	$/cwt.	2.47	20.1	1.83
19	**Fall Lettuce**	$/cwt.	5.40	20.6	3.98
20	**Early Spring Cantaloupes**	$/cwt.	7.32	22.2	5.24
21	**Early Spring Lettuce**	$/cwt.	5.54	24.9	3.77
22	**Potatoes**	$/cwt.	3.09	29.9	1.90
23	**Onions**	$/cwt.	3.52	36.6	1.87

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[1] *The data are taken from Arizona Agricultural Statistics 1966, 1967, 1968. This yearly publication is compiled by the Arizona Crop and Livestock Reporting Service, U. S. Department of Agriculture, Statistical Reporting Service and published in cooperation with the Department of Agricultural Economics, The University of Arizona.*

crops. The true income-risk effect of this can only be determined with the addition of yield variabilities.

Yield Variability

The yield variability data are presented in Table 2. Here again there is no need to go into great detail in discussing the data. This information is presented to establish the nature and magnitude of the factors determining the all-important income variabilities.

It is worthy to note in passing that in general there is less variability associated with yields than there was with prices. The highest variability coefficient on yield is 27.4, while for price the highest was 36.6. Given the relative stability of Arizona's climate and the general nature of the prices of agricultural commodities, this is to be expected.

Gross Income Variability

It is now possible to combine the separate price and yield components and derive the gross income variabilities. This will enable us to evaluate the relative "riskiness" of the various crops.

The individual crop gross income variability data are presented in Table 3. The mean or expected gross income per acre, Column 1, is a simple product of the mean price and yield, Column 1 of Tables 1 and 2.

The "risk ranking" of the various crops is not at all surprising. However, the magnitudes of the income effects are. The application of the variability coefficients to the mean gross incomes at the pessimistic 10 percent probability level leaves a strong impression. For example, the "Bad Year" gross income on crop 23, onions, is $684 below the mean gross income per acre. This is truly a "risky" crop. At the same time it should be pointed out that the gross income from onions is the highest of the crops considered.

The selection of a cropping system involves much more than what has been presented here; e.g., costs, soil conditions, availability of water, etc. This discussion is not at all intended to imply that a "risky" crop is something to be avoided under all circumstances. Certainly those who are willing and able to accept the "risk" will reap the highest profits (assuming other things equal). For over time the good and bad years will cancel each other out; and in this the "long run," the mean income is applicable.

Certain individuals, however, may not be able to wait for the long run. As an example, a bad year on 100 acres of onions would undoubtedly place a capital-poor beginning farmer at or near bankruptcy. Under the assumption of a bad year price, $1.87, a 270-hundredweight yield would lead to our bad year gross income of $504.79 per acre. At a normal harvest cost of $1.60 per hundredweight, each hundredweight would recapture $.27 of the preharvest costs ($1.87-$1.60). Consequently, it would pay to harvest, but only $73 of the typical $160 per acre preharvest cost would be salvaged ($73 = $.27 x 270 hundredweight). The resultant loss would be $87 an acre or $8,700 on the 100 acres, and this includes no fixed costs such as land payments, depreciation, or supervisory labor.

It is hoped that the data presented herein will be useful for both the new and the experienced farmer in the process of making just such an evaluation.

Table 3. Ranking of Arizona Crops by Gross Income Variability Coefficients.[a]

Rank	*Crop*	*Mean $/Acre* (*gross income*)	*Var. Coeff.*	*Bad Year* (*gross income*)
1	**Barley**	81.00	4.1	76.69
2	**Corn**	43.79	4.2	41.42
3	**Grain Sorghum**	88.43	6.6	80.96
4	**Alfalfa Hay**	142.95	8.0	128.33
5	**Wheat**	77.10	8.8	68.37
6	**Grain Hay**	57.07	9.8	49.92
7	**Upland Cotton**	328.59	11.8	278.87
8	**Winter Broccoli**	854.40	13.7	704.34
9	**Oats**	47.29	14.6	38.43
10	**Summer Cantaloupes**	910.60	16.0	823.31
11	**Alfalfa Seed**	55.83	18.0	42.93
12	**Winter Lettuce**	793.70	20.3	587.59
13	**Fall Lettuce**	876.00	20.8	641.91
14	**Winter Cauliflower**	809.20	23.9	561.18
15	**Early Summer Watermelons**	403.35	24.7	275.64
16	**Long Staple Cotton**	300.91	25.6	202.34
17	**Carrots**	904.83	25.7	606.80
18	**Potatoes**	719.10	30.3	439.61
19	**Winter Cabbage**	687.40	31.1	413.26
20	**Early Spring Lettuce**	1,076.65	31.4	643.83
21	**Honeydew Melons**	848.50	32.8	492.10
22	**Early Spring Cantaloupes**	889.90	33.2	511.48
23	**Onions**	1,189.19	44.9	504.79

[a]*Dollars per acre basis.*

Table 2. Ranking of Arizona Crops by Yield Variability Coefficients.

Rank	*Crop*	*Units*	*Mean* (*yield*)	*Var. Coeff.*	*Bad Year* (*yield*)
1	**Alfalfa Hay**	tons	5.12	3.7	4.88
2	**Barley**	cwt.	32.26	4.0	30.61
3	**Grain Hay**	tons	2.20	4.3	2.07
4	**Grain Sorghum**	cwt.	40.82	5.5	37.93
5	**Upland Cotton**	lbs.	1,100.60	5.6	1,021.08
6	**Winter Lettuce**	cwt.	166.00	6.3	152.51
7	**Fall Lettuce**	cwt.	163.00	6.6	149.13
8	**Corn**	cwt.	15.68	6.7	14.32
9	**Wheat**	cwt.	26.28	7.4	23.77
10	**Potatoes**	cwt.	235.00	8.5	209.26
11	**Early Spring Lettuce**	cwt.	190.00	10.4	164.59
12	**Winter Broccoli**	cwt.	66.00	11.5	56.31
13	**Summer Cantaloupes**	cwt.	118.00	11.5	100.60
14	**Alfalfa Seed**	cwt.	188.00	13.4	155.72
15	**Early Summer Watermelons**	cwt.	162.00	13.7	137.47
16	**Onions**	cwt.	329.67	15.0	266.45
17	**Long Staple Cotton**	lbs.	598.60	15.6	479.12
18	**Oats**	cwt.	15.48	15.7	12.35
19	**Carrots**	cwt.	189.33	18.5	144.54
20	**Winter Cabbage**	cwt.	181.00	18.5	137.96
21	**Early Spring Cantaloupes**	cwt.	123.00	26.4	81.42
22	**Honeydew Melons**	cwt.	123.00	27.3	79.96
23	**Winter Cauliflower**	cwt.	65.40	27.4	42.45