

High yields begin with a soil that has high yield potential. An ideal soil is loamy with a high exchange capacity, has good water holding capacity, and internal drainage. It should be free of toxic materials, pathogens, and weeds. Continuous use of the same crop on the same land year after year requires special care if a good soil is to remain that way. Crop rotation is still a viable building block in a program that seeks to maximize yields and economic returns.

Crop yield is the tangible result of the interaction of genetic potential and environment. Choice of the best planting date is an important building block. It interacts with many things. If it is to achieve its genetic potential, each crop or variety must accumulate a specific number of growing degree days. Also, many crops respond to day-length.

When environmental conditions favoring plant growth are optimized, the major limiting factor to total yield for alfalfa and grain crops appears to be leaf area and the way leaves are displayed by the plant. Most of a plant's dry matter results from photosynthesis. Under ideal conditions, a grower seeks to maximize use of light (energy) by timely planting of an optimum stand. The population goal calls for uniform plants that maximize yield. Generally, for a forage crop stand, it is best to err on the side of too thick rather than too thin. For any crop, yields may be reduced severely when there are areas without plant cover. Thus, stand sets the stage for much that follows after planting.

Top-yield farmers are never satisfied with their current yields and they look everywhere for new ideas. They are almost always humble about their successes. They freely share fine-points concerning their inputs with neighbors and with agricultural scientists. The College of Agriculture often gets excellent ideas for research and extension breakthroughs from these innovative farmers.

The future for productivity of alfalfa and grain crops in Arizona is bright. With continued strong support for Research and Extension, the trend of average yields in Arizona will continue upward and no one can predict the heights that yields will eventually reach.

Cost of Producing Forage and Grain in Arizona

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Alfalfa hay production in Arizona is concentrated in two counties--Maricopa and Yuma--where 77 percent of the crop was produced in 1978 (see Table 1). In 1978 Arizona produced 1.298 million tons of alfalfa hay on 206,000 acres for an average yield of 6.3 tons per acre. Comparing 1978 data with that for the 1972-76 period average, acreage decreased about 2.6% and the yield per acre decreased slightly from 6.4 tons to 6.3 tons.

Wheat production is concentrated in Maricopa, Pinal, and Yuma Counties where 92 percent of the 1978 crop was produced. Arizona produced 289,800 tons of wheat in 1978 on 138,000 acres with an average yield of 2.10 tons per acre. Compared with 1972-76 five year average, 1978 Arizona wheat acreage declined 45 percent.

Maricopa and Pinal Counties are the principal producers of barley, producing 74 percent of the total crop in 1978. Total production in 1978 was 59,640 tons on 35,000 acres with an average yield of 1.70 tons per acre. Barley acreage in 1978 was down 55 percent from the 1972-76 average.

Sorghum grain is produced primarily in Cochise, Graham, Maricopa and Yuma Counties where 81 percent of the 1978 crop was produced. Arizona produced 159,430 tons of grain sorghum in 1978 on 73,000 acres with an average yield of 2.18 tons per acre. Compared to the 1972-76 average, the acreage devoted to grain sorghum declined 32 percent in 1978.

Although corn is produced in several counties with Cochise County as the principal producer, it ranks second in order of production below wheat.

The profit contribution margin (sales less the variable expenses of production) was sufficient to cover all overhead expenses of 1979 alfalfa hay production and to return a profit of \$11.23, 15.08, 12.22, 20.50 and 12.86 per ton in Cochise, Graham, Maricopa, Pima and Yuma Counties, respectively (see Table 2). Although the profit contribution margin in Pinal County was positive, (greater than zero) it fell short of covering all overhead expenses of production.

Yuma County was the only county where 1979 wheat produced a profit (see Table 3). In all other counties considered, the profit contribution margin was greater than zero but not sufficiently large to cover all overhead expenses of production.

In the case of 1979 sorghum grain production the story is about the same as for wheat. Only Graham and Yuma Counties showed a profit while the other counties did not (see Table 4). Again, the profit contribution margin was not large enough to cover all of the overhead expenses of production.

In a majority of the cases alfalfa and grain crops are grown in a crop mix containing cotton. As long as the profit contribution margin is positive and greater than zero the grower will make more profit from the crop mix by including the hay or grain crop in the crop mix, even though the enterprise itself does not show a profit. From observation, it appears that Arizona growers are well aware of this economic axiom and that they also put it into practice.

Table 1. Forage and Grain Production in Arizona, 1972-78

Crop	Cochise	Graham	Maricopa	Pima	Pinal	Yuma	Other ^{1/}	Arizona
1972-76 Average Production (tons)								
Alfalfa hay	50,000	39,282	625,920	11,700	92,520	462,480	67,298	1,349,200
Wheat	75,868	8,102	165,150	17,178	115,166	139,478	4,038	524,980
Barley	6,614	10,414	63,002	8,446	40,362	7,242	1,220	137,300
Sorghum	95,762	45,444	40,162	10,474	14,964	13,092	2,540	222,438
Corn	7,496	302	2,820	126	42	1,630	5,666	18,082
1978 Production (tons)								
Alfalfa hay	65,000	58,500	538,000	12,000	80,000	462,000	82,500	1,298,000
Wheat	7,310	3,870	87,120	7,060	97,360	80,880	6,200	289,800
Barley	1,510	1,900	24,860	2,500	19,010	9,000	860	59,640
Sorghum	28,980	24,640	41,890	5,790	14,310	34,270	9,550	159,430
Corn	133,640	12,600	770	---	---	---	13,990	161,000

^{1/} Principally Greenlee, Mohave, Navajo and Yavapai Counties.

Source: 1978 Arizona Agricultural Statistics.

Table 2. Projected 1979 Alfalfa Hay Production Costs and Returns in Selected Counties in Arizona

Item	Cochise	Graham	Maricopa	Pima	Pinal	Yuma
Seedbed preparation	\$ 0	0	0	0	0	0
Planting and cultivating	\$ 0	0	6	0	6	23
Crop irrigation	\$ 239	88	81	115	216	57
Chemicals and application	\$ 3	0	45	0	13	49
Harvest - post harvest	\$ 71	166	121	100	168	155
Overhead	\$ 134	168	174	142	150	186
Total cost per acre	\$ 447	422	427	357	553	470
Yield, tons per acre (1978)	6.5	6.5	6.3	6.0	5.0	7.0
Break-even cost per ton	\$ 68.77	64.92	67.78	59.50	110.60	67.14
Market price per ton	\$ 80.00	80.00	80.00	80.00	86.00 ^{a/}	80.00
Profit per ton ^{1/}	\$ 11.23	15.08	12.22	20.50	-24.60	12.86
Gross receipts per acre	\$520.00	520.00	504.00	480.00	400.00	560.00
Variable cost per acre	\$238.86	174.48	213.32	181.79	362.50	227.87
Profit contribution margin ^{2/}	\$281.14	345.52	290.68	298.21	37.50	332.13
Water cost per acre	\$214.42 ^{b/}	59.88 ^{c/}	65.98 ^{d/}	102.00 ^{e/}	189.26	35.41 ^{f/}
Water cost per acre foot	\$ 37.84	8.56	10.56	17.00	30.29	5.00

^{1/} Profit per ton equals market price less the break-even cost per ton.

^{2/} Profit contribution margin equals gross receipts from an acre less the variable expenses of producing that acre.

a/ Alfalfa cubes.

b/ Pump water.

c/ Water is a combination of surface and pump water.

d/ Water supplied by the Salt River Project.

e/ Water supplied by the Cortaro Water Users Association.

f/ Surface water from Colorado River.

Source: Yield data compiled from 1978 Arizona Agricultural Statistics.

Cost data compiled from 1979 Field Crop Budgets for the counties considered.

Table 3. Projected Wheat Production Costs and Returns in Selected Counties in Arizona, 1979

Item	Cochise	Graham	Maricopa	Pima	Pinal	Yuma
Seeded preparation	\$ 18	11	9	15	9	13
Planting and cultivating	\$ 20	59	19	18	28	18
Crop irrigation	\$ 137	55	33	65	102	28
Chemicals and application	\$ 40	11	62	30	44	27
Harvest - post harvest	\$ 26	49	32	37	36	33
Overhead	\$ 71	66	106	87	74	68
Total cost per acre	\$ 312	251	261	252	293	187
Yield, tons per acre (1978)	1.93	1.94	2.13	2.08	2.09	2.19
Break-even cost per ton	\$161.66	129.38	122.54	121.15	140.19	85.39
Market price per ton	\$105.00	105.00	105.00	105.00	105.00	105.00
Profit per ton ^{1/}	\$-56.66	-24.38	-17.54	-16.15	-35.19	19.61
Gross receipts per acre	\$202.65	203.70	223.65	218.40	219.45	229.95
Variable cost per acre	\$201.22	148.19	146.67	161.90	185.54	105.82
Profit contribution margin ^{2/}	\$ 1.43	55.51	76.98	56.50	33.91	124.13
Water cost per acre	\$126.16 ^{b/}	35.64 ^{c/}	25.08 ^{d/}	56.67 ^{e/}	89.59 ^{b/}	16.24 ^{f/}
Water cost per acre foot	\$ 37.84	8.56	7.92	17.00	30.29	5.00

^{1/} Profit per tons equals market price less the break-even cost per ton.

^{2/} Profit contribution margin equals gross receipts from an acre less the variable expenses of producing that acre.
b/ Pump water.

c/ Water is a combination of surface and pump water.

d/ Water supplied by the Salt River Project.

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f/ Surface water from Colorado River.

Source: Yield data compiled from 1978 Arizona Agricultural Statistics.

Cost data compiled from 1979 Field Crop Budgets for the counties considered.

Table 4. Projected Sorghum Production Costs and Returns in Selected Counties in Arizona, 1979

Item	Cochise	Graham	Maricopa	Pima	Pinal	Yuma
Seedbed preparation	\$ 30	18	21	15	14	9
Planting and cultivating	\$ 44	43	4	15	9	11
Crop irrigation	\$ 158	53	58	63	127	32
Chemicals and application	\$ 11	32	38	30	46	29
Harvest - post harvest	\$ 32	55	30	40	27	35
Overhead	\$ 86	69	102	89	70	64
Total cost per acre	\$ 361	270	254	252	293	180
Yield, tons per acre (1978)	3.22	3.08	1.91	1.93	2.05	1.91
Break-even cost per ton	\$112.11	87.66	132.98	130.57	142.93	94.24
Market price per ton	\$105.00	105.00	105.00	105.00	105.00	105.00
Profit per ton ^{1/}	\$ -7.11	17.34	-27.98	-25.57	-37.93	10.76
Gross receipts per acre	\$338.10	323.40	200.55	202.65	215.25	200.55
Variable cost per acre	\$231.27	149.13	139.41	159.46	184.79	102.97
Profit contribution margin ^{2/}	\$106.83	174.27	61.14	43.19	30.46	97.58
Water cost per acre	\$145.04 ^{b/}	31.39 ^{c/}	51.00 ^{d/}	53.83 ^{e/}	111.04 ^{b/}	15.00 ^{f/}
Water cost per acre foot	\$ 37.84	8.56	17.00	17.00	30.29	5.00

1/ Profit per tons equals market price less the break-even cost per ton.

2/ Profit contribution margin equals gross receipts from an acre less the variable expenses of producing that acre.

b/ Pump water.

c/ Water is a combination of surface and pump water.

d/ Water supplied by the Salt River Project.

e/ Water supplied by the Cortaro Water Users Association.

f/ Surface water from Colorado River.

Source: Yield data from 1978 Arizona Agricultural Statistics.

Cost data compiled from 1979 Field Crop Budgets for the counties considered.