TABLE I.

SUMMARY OF CASSAVA VARIETY YIELD-TEST DATA

Selection	Tuber $\bar{X}$ tuber/ plant	Tuber $\bar{X}$ yield lb/plant	Projected Yield Tuber Ton/Acre	Projected Yield Starch* Ton/Acre	Forage $\bar{X}$ Yield lb/plant	Projected Yield Forage Ton/Acre	Total Biomass lb/plant	Projected Total Biomass Ton/Acre	Dry Matter lb/plant	Projected Dry Matter Ton/Acre
M. Ven 218	6.5±1.9	2.4±10	17.8	5.7	2.7±1.3	20.	5.1 ±2.3	38.	1.0	7.41
M. Col.22	11.3±5.4	3.1±0.9	23.0	7.4	3.9±1.0	29.	7.0±1.9	59.	1.48	11.0
CMC 40	6.3±2.3	2.9±1.3	21.5	6.9	5.4±2.4	40.	8.3±3.7	61.5	1.80	13.3
M. Mex 59	5.8±2.3	1.42±0.7	10.5	3.4	7.0±2.5	52.	8.42±3.2	62.4	2.2	16.3
MITA 1158	9.0	2.8	20.7	6.6	12.3	91.	15.1	111.	3.9	28.8
LANERA	5.0	1.5	11.1	3.5	5.5	41.	1.6	12.	1.7	12.6

Planting density was one plant/square meter, projected to 6,000 plants/hectare or 2,400 plants/acre.

Irrigation was 30 inches; the growing season, 8 months.

* tuber starch content = 32% (fresh peeled tuber)
tuber moisture content = 93%
forage moisture content = 70%

The forage and tuber yields were reduced, but respectable, considering the radical differences in environment. Commercial production of Cassava in the Southwest is envisioned to be a low energy "input" crop (requiring little fertilizer, water, and "less than ideal" crop land) with a high "output" of forage (suitable for animal feed) and starch (for food or local conversion to ethanol).

The primary limitation to Cassava cultivation appears to be a lack of cold tolerance in the wild relatives of Cassava which are native to Arizona and Cassava may overwinter satisfactorily in the Yuma area. If an overwintering Cassava cultivar could be developed for the Southwest, Cassava could be cultivated as a multiple-cutting forage crop with tubers being harvested on alternate years.

Cost of Producing Forage and Grain in Arizona

Dr. Scott Hathorn Jr., Extension Economist

Alfalfa hay production in Arizona is concentrated in two counties--Maricopa and Yuma--where 75 percent of the crop was produced in 1980 (see Table 1). In 1980 Arizona produced 1.115 million tons of hay on 165,000 acres for an average yield of 7.0 tons per acre. Comparing 1980 data with that for the 1972-76 period average, acreage decreased about 23.2% and the yield per acre increased slightly from 6.6 tons to 7.0 tons.

Wheat production is concentrated in Maricopa, Pinal, and Yuma Counties where 91 percent of the 1980 crop was produced. Arizona produced 516,000 tons of wheat in 1980 on 215,000 acres with an average yield of 2.40 tons per acre. Compared with 1972-76 five year average, 1980 Arizona wheat acreage declined 14 percent.

Maricopa and Pinal Counties are the principal producers of barley, producing 77 percent of the total crop in 1980. Total production in 1980 was 94,800 tons on 50,000 acres with an average yield of 1.90 tons per acre. Barley acreage in 1980 was down 35 percent from the 1972-76 average.

Sorghum grain is produced primarily in Cochise, Graham, Maricopa and Pinal Counties where 74 percent of the 1980 crop was produced. Arizona produced 54,600 tons of grain sorghum in 1980 on 26,000 acres with an average yield of 2.10 tons per acre. Compared to the 1972-76 average, the acreage devoted to grain sorghum declined 76 percent in 1980.

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

Although the profit contribution margin (sales less the variable expenses of production) was sufficient to cover variable expenses of alfalfa hay production in 1981, only in the case of Maricopa County was it large enough to cover all overhead costs and return a profit (see Table 2). Profit per ton of alfalfa hay production in Cochise, Graham, Maricopa, Pima, Pinal and Yuma Counties was $-14.17, -4.76, +3.38, -1.00, -14.63, and -1.92, respectively.

With respect to 1981 wheat, all counties--Graham, Maricopa, Pima, Pinal, and Yuma--produced a profit with the exception of Cochise County (see Table 3). The loss in Cochise County amounted to $12.49 per ton. Although the profit contribution margin was greater than zero, it fell short of covering all overhead expenses of production in Cochise County.

In the case of 1981 sorghum grain production the story is not encouraging. Sorghum grain was a money loser in 1981 in all of the counties (see Table 4). The profit contribution margin was not large enough to cover all of the overhead expenses of production in Graham, Maricopa, Pima and Yuma Counties. In Cochise and Pinal Counties, the profit contribution was negative. This means that the variable cost of production exceeded the gross receipts generated by the crop.

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 gain 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. Sorghum growers in Cochise and Pinal Counties should seriously consider still further reductions in acreage as this crop is not returning the variable cost of production.

Table 1. Forage and Grain Production Data for Arizona, 1972-80

County and Crop	1972-76 Average			1980		
	Acreage	Yield[1/]	Production	Acreage	Yield[1/]	Production
		(lbs.)	(tons)		(lbs.)	(tons)
COCHISE						
Alfalfa Hay	9,520	5.2	50,000	10,000	6.0	60,000
Wheat	38,500	3,888	75,868	3,200	4,620	7,390
Barley	4,080	3,254	6,614	900	3,040	1,370
Sorghum	40,880	4,690	95,762	6,200	4,790	14,840
Corn	2,500	5,997	7,496	28,000	6,270	87,810
GRAHAM						
Alfalfa Hay	7,600	5.1	39,282	7,500	6.3	47,000
Wheat	3,980	4,008	8,102	6,000	4,460	13,370
Barley	5,700	3,696	10,414	2,000	3,840	3,840
Sorghum	20,760	4,398	45,444	3,000	4,670	7,000
Corn	120	5,033	302	4,000	5,490	10,980
MARICOPA						
Alfalfa Hay	95,340	6.6	625,920	55,000	7.4	406,000
Wheat	75,860	4,294	165,150	97,000	4,880	236,850
Barley	33,720	3,728	63,002	16,000	3,880	31,010
Sorghum	22,320	3,620	40,162	3,400	4,040	6,860
Corn	1,760	3,158	2,820	-	-	-
PIMA						
Alfalfa Hay	2,020	5.8	11,700	2,000	5.5	11,000
Wheat	8,800	3,834	17,178	3,200	4,270	6,830
Barley	4,800	3,628	8,446	2,000	3,360	3,360
Sorghum	6,700	3,414	10,474	1,800	4,040	3,640
Corn	100	2,520	126	-	-	-
PINAL						
Alfalfa Hay	17,280	5.4	92,520	15,000	6.4	95,500
Wheat	55,520	4,056	115,166	63,500	4,590	145,770
Barley	24,300	3,354	40,362	22,000	3,830	42,100
Sorghum	8,140	3,678	14,964	5,900	3,940	11,620
Corn	-	-	-	-	-	-
YUMA						
Alfalfa Hay	63,280	7.3	462,480	60,000	7.8	466,000
Wheat	64,040	4,272	139,478	32,800	5,410	88,720
Barley	4,360	3,428	7,242	6,000	3,780	11,350
Sorghum	7,700	3,436	13,092	3,000	4,020	6,020
Corn	980	3,336	1,630	-	-	-
OTHER[2/]						
Alfalfa Hay	19,760	6.9	135,498	15,500	4.5	69,500
Wheat	2,500	3,230	4,038	12,500	2,731	17,070
Barley	840	2,904	1,220	1,100	3,218	1,770
Sorghum	1,300	3,908	2,540	2,700	3,422	4,620
Corn	9,340	1,222	5,708	8,000	3,303	13,210
ARIZONA						
Alfalfa Hay	214,800	6.6	1,417,400	165,000	7.0	1,155,000
Wheat	249,200	4,140	524,980	215,000	4,800	516,000
Barley	77,800	3,534	137,300	50,000	3,790	94,800
Sorghum	107,800	4,168	222,438	26,000	4,200	54,600
Corn	14,800	2,172	18,082	40,000	5,600	112,000

1/ Alfalfa hay yield unit is tons.

2/ Principally Greenlee, Mohave, Navajo and Yavapai Counties.

Source: 1980 Arizona Agricultural Statistics.

Table 2. Projected Alfalfa Hay Production Costs and Returns in Selected Counties in Arizona, 1981

Item	Cochise	Graham	Maricopa	Pima	Pinal	Yuma
Seedbed preparation	$ 0	0	0	0	0	0
Planting and cultivating	$ 0	0	7	0	7	26
Crop irrigation	$ 278	95	99	130	240	75
Chemicals and application	$ 5	0	63	0	17	66
Harvest - post harvest	$ 104	211	155	131	175	202
Overhead	$ 178	229	243	201	204	269
Total cost per acre	$ 565	534	567	462	644	639
Yield, tons per acre (1980)	6.0	6.3	7.4	5.5	6.4	7.8
Break-even cost per ton	$ 94.17	84.76	76.62	84.00	100.63	81.92
Market price per ton	$ 80.00	80.00	80.00	83.00	86.00 a/	80.00
Profit per ton 1/	$-14.17	-4.76	3.38	-1.00	-14.63	-1.92
Gross receipts per acre	$480.00	504.00	592.00	456.50	550.40	624.00
Variable cost per acre	$308.20	202.98	273.32	220.02	396.18	298.37
Profit contribution margin 2/	$171.80	301.02	317.68	236.48	154.22	325.63
Water cost per acre	$195.84 b/	65.61 c/	82.76 d/	114.00 e/	210.71	46.75 f/
Water cost per acre foot	$ 44.16	9.37	13.24	19.00	33.71	6.60

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

2/ Profit contribution margin equals gross receipts less the variable expenses of production.

a/ Alfalfa cubes.

b/ Pump water (includes well depreciation, insurance, repairs, and energy).

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 1980 Arizona Agricultural Statistics.
Cost data compiled from 1981 Field Crop Budgets for the counties considered.

Table 3. Projected Wheat Production Costs and Returns in Selected Counties in Arizona, 1981

Item	Cochise	Graham	Maricopa	Pima	Pinal	Yuma
Seedbed preparation	$ 25	15	13	21	13	18
Planting and cultivating	$ 29	81	29	27	42	31
Crop irrigation	$ 160	59	40	74	114	37
Chemicals and application	$ 54	16	74	38	45	39
Harvest - post harvest	$ 37	69	42	49	46	43
Overhead	$ 104	93	164	86	108	106
Total cost per acre	$ 410	333	362	295	368	273
Yield, tons per acre (1980)	2.31	2.23	2.44	2.14	2.30	2.71
Break-even cost per ton	$177.49	149.33	148.36	137.85	160.00	100.74
Market price per ton	$165.00	165.00	165.00	165.00	165.00	165.00
Profit per ton[1/]	$-12.49	15.67	16.64	27.15	5.00	64.26
Gross receipts per acre	$381.15	367.95	402.60	353.10	379.50	447.15
Variable cost per acre	$268.19	193.00	188.67	208.20	221.61	152.59
Profit contribution margin[2/]	$112.96	174.95	213.93	144.90	157.89	294.56
Water cost per acre	$147.20[b/]	39.06[c/]	31.22[d/]	63.33[e/]	99.73[b/]	21.46[f/]
Water cost per acre foot	$ 44.16	9.37	9.86	19.00	33.71	6.60

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

2/ Profit contribution margin equals gross receipts less the variable expenses of production.

b/ Pump water (includes well depreciation, insurance, repairs, and energy).

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 1980 Arizona Agricultural Statistics.
Cost data compiled from 1981 Field Crop Budgets for the counties considered.

Table 4. Projected Sorghum Production Costs and Returns in Selected Counties in Arizona, 1981

Item	Cochise	Graham	Maricopa	Pima	Pinal	Yuma
Seedbed preparation	$ 40	25	27	21	19	13
Planting and cultivating	$ 58	57	6	19	11	14
Crop irrigation	$ 168	57	73	71	142	43
Chemicals and application	$ 15	45	52	36	61	39
Harvest - post harvest	$ 45	76	39	51	44	46
Overhead	$ 112	92	154	82	98	96
Total cost per acre	$ 437	353	350	280	376	251
Yield, tons per acre (1980)	2.40	2.34	2.02	2.02	1.97	2.01
Break-even cost per ton	$182.08	150.85	173.27	138.61	190.86	124.88
Market price per ton	$110.00	110.00	110.00	110.00	110.00	110.00
Profit per ton 1/	$-72.08	-40.85	-63.27	-28.61	-80.86	-14.88
Gross receipts per acre	$264.00	257.40	222.20	222.20	216.70	221.10
Variable cost per acre	$282.17	188.16	181.13	195.19	230.61	139.94
Profit contribution margin 2/	$-18.17	69.24	41.07	27.01	-13.91	81.16
Water cost per acre	$154.56 b/	34.36 c/	64.50 d/	60.17 e/	123.62 b/	19.80 f/
Water cost per acre foot	$ 14.16	9.37	21.50	19.00	33.71	6.60

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

2/ Profit contribution margin equals gross receipts less the variable expenses of production.

b/ Pump water (includes well depreication, insurance, repairs, and energy).

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.

Sources: Yield data from 1980 Arizona Agricultural Statistics.
Cost data compiled from 1981 Field Crop Budgets for the counties considered.