VEGETABLE CROP RESEARCH

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American Samoa, the only U.S. territory in the South Pacific, is about 2,300 (3,702 km) miles Southwest of Hawaii. It is composed of Seven Islands with an aggregate area of approximately 76.2 square miles (197.3 sq.km). Of the seven Islands five are volcanic - Aunu'u, Ofu, Olosega, Ta'ū and Tutuila and two are coral atolls - Swain and Rose. In 1984, the total population of American Samoa was about 34,950. (4)

Tutuila, where Pago Pago is located is the largest island with an area of approximately 33,920 acres (13,700 ha). It is approximately 22 miles (35.4 km) long and about 6miles (9.6 km) wide at the widest part (Fig. 1, appendix).

CLIMATE AND SOILS

The Islands are mountainous and most places have slopes greater than 20 per cent. Soils are predominantly clayey and generally rocky. pH ranges from moderately acid to neutral, and usually contain a fair amount of organic matter (2).

The climate in American Samoa is characterized by heavy rainfall, warm temperatures and high humidity. The 20-year annual average was estimated at 317 cm. Rainfall is farly well-distributed through out the year with a slight drop during the months of June to September (table 1, appendix).

AGRICULTURE

Farming in American Samoa is mostly of the subsistence type. Taro, breadfruits, bananas and coconuts are the most important crops. Other crops grown are papayas, cassava, yams and cocoa. Some farmers grow vegetables such as cucumbers, bean (Vigna sp) cabbages (mostly of the pekinensis species) white radish and squash (Curcurbita) for the local market and the fishing boats.

INFLUENCE OF SUPPORT ON THE YIELD OF BEANS

In American Samoa, Beans (Vigna sesquepedalis) common referred to as sankebeans or yard long beans are commonly grwon with supports for the vines to climb on. Putting up of supports however means additional expense in labor, time and of course money if supports have to be purchased which is often the case. If supports could be eliminated without impairing yields, it would be an improvements particularly on the economics of production. With this in mind an experiment with the following treatments replicated three times arranged in a randomized complete blacks design was conducted:

a. control - No support. Plants lay on the ground.
b. single post support - One post about 1.8 mm long was provided to every hill.
c. Teepe-type support - This kind of support commonly used by local gardeners. Two posts, are erected on opposite sides of the hill. The top ends are tied-up together forming an inverted V. A sticks is placed horizontally at the top ends to connect the supports of adjacent hills.
d. Clothes line type support - Posts are put up along the row about 3 meters apart. They are connected with two pieces of string - one piece is laid out about two feet from the ground and any other, at about 5 feet from the ground.

Yield evaluations showed that the different kinds of supports had no bearing on the yield of snake beans (table 2). The results further showed that yields from the contril plots are statistically comparable with those treatment that have supports. However, management operations such as weeding, cultivation application of fertilizer spraying for pests and decreases and harvesting are more conveniently done on those treatments with plants grown with supports.

Table 2
Influence of type of supports on the yields of beans, kg/ha.

	Replication				
Treatment	I	II	II	Total	Mean 1/
Control	3,262	3,262	4,485	11,009	3,670
Teepe-type	3,851	3,352	3,398	10,601	3,533
Clothesline Type	4,775	3,262	2,945	10,782	3,594
Single Post	3,398	3,582	3,760	10,740	3,580

1/ Differences between means are insignificant.

CABBAGE VARIETY TRIAL

An experiment to evaluate yield performance of 5 varieties of heading cabbage (Brassica oleracea var. Capitata) under humid tropical lowland conditions was conducted.

Heading Cabbabe is basically a cool season crop. Many cabbage varieties do not produce heads very well in hot and humid - climate such as that prevails in the lowlands areas of American Samoa.

Five cabbage varieties were selected for the study namely, Tropic Drum, Tropic Globe, County Green, Yates and Jubilee. Experimental design was randomized complete blocks with three replications. Plot size was 17 feet by 6 feet (5.2x1.8m). There were 27 plants per treatment.

Seeds were sown in seed boxes. A month after sowing, the seedlings were transplanted in the field. Distance of planting was 2.5 feet (76 cm) between rows and 2 feet (61 cm) in the row. A week after transplanting plants were fertilized with 12-6-18 fertilizer mixture at the rate of 1/2 table spoonful per plant. Fertilizers were applied around the plants. At head initiation trial, plants were fertilized again with the same fertilizer mixture at the rate of 1 table spoonful per plant.

Diamond-back moth was the most important pest observed during the trial. Degree of damage differed with variety. Jubilee variety was completely destroyed by the pest. Other varieties sustained insignificant damage.

Black rot was the most important disease observed. The disease was characterized initially by yellowing of the leaves and blackening of the veins. County Green variety appeared most resistant to the disease.

Yields of marketable heads, percentage of head production and average weight of heads are presented in tables 3, 4, and 5.

Table 3
Marketable Head Production
tons per hecture

Variety	I	II	III	TOTAL	MEAN 1/
Yates	2.04	2.12	4.00	8.16	2.72 [b]
Tropic Globe	16.28	8.15	8.54	32.97	10.99 [a]
County Green	9.11	6.17	7.19	23.01	7.67 [a]
Tropic Drum	8.35	8.35	8.15	24.85	8.28 [a]

1/ Differences between means with different letters are significant at 1% brel.

Table 4

Percentage of Head Production

Variety	Replication I	II	III	Total	Mean 1/
Yates	13	16	22	51	17 a
Tropic Drum	74	59	85	218	73 b
Tropic Globe	92	89	70	251	84 b
County Green	79	43	74	196	65 b

1/ Means with different letters are statistically different at 1% level.

Table 5

Average weight of cabbage heads in grams

Variety	I	II	III	Total	Mean 1/
Yates	540	580	540	1,660	550
Tropic Drum	390	460	480	1,330	440
Tropic Globe	680	490	500	1,670	550
County Green	680	540	480	1,700	560

1/ Differences between means not significant.

It can be seen in the foregoing tables that varieties Tropic Globe, Tropic Drums and County are the best producers. It can also be seen in table 5 that head size did not differ among varieties. Differences in yield was mainly due to percentage of head production (table 4).

YIELD EVALUATION OF TWO VARIETIES OF CUCUMBERS

The yield performance of Giant climbing variety of cucumber. (Takii Seed Company, Japan) was tested against variety Marketer No.2 (Known You Seed Company, Taiwan) which is commonly grown by our local farmers.

Plot size was 20 feet by 20 feet (6m x 6m). The treatments were arranged in a randomized complete blocks design. There were three replications.

Planting was done on October 17, 1983. Three to four seeds were planted per hill. Hills were spaced 4x4 feet (1.2 x 1.2 m). One week after emergence hills were thinned out leaving two healthy seedlings to a hill. At the time of thinning, fertilizers (12-6-18) were applied at the rate of one table spoonful per hill. Another application of the same fertilizer mixture was done at the rate of two tablespoonfuls per hill when plants started to bloom.

The first fruits of Marketer No. 2 were harvested 38 days after planting. First harvest on the Giant climbing variety was done 11 days later. Succeeding harvests were done two times a week until the plants reached the end of their fruiting period. Total harvesting period for Marketer No. 2 was approximately 32 days and 21 days for the giant Climbing variety.

Total marketable yields and average weight of marketable fruits are presented in tables 6 and 7.

Table 6

Marketable Yields of Cucumber, T/ha

Variety	I	II	III	Total	Mean 1/
Giant Climbing	16.5	11.3	15.9	43.7	14.6
Marketer No. 2	17.8	28.0	17.9	63.7	21.2

1/ Differences between means not significant.

Table 7

Average weight of cucumbers, grams

Variety	I	II	III	Total	Mean 1/
Giant Climbing	509	481	527	1,518	506
Marketer No. 2	536	536	623	1,595	522

1/ Differences between means not significant.

WATERMELON VARIETY TRIAL

A Yield evaluation trial involving three varieties of watermelon was conducted. Charleston Gray variety, a variety commonly grown in Tonga and usually exported to American Samoa was tested against Sugar Baby and Allsweet varieties.

The treatments (varieties) were arranged in a radomized complete blocks design with three replications. There were six hills per treatment and three plants were maintained per hill. Hills were spaced 8x8 feet (2.4 m by 2.4 m).

Seeds were planted on October 25, 1983. Fertilizers (12-6-18) at the rate of one table spoonful per hill was mixed with the soil before planting the seeds. Five seeds were planted per hill. A weed after emergence, hills were thinned out leaving three healthy plants to a hill.

Eighty days after planting Sugar Baby variety was ready for harvest. Charleston Gray and Allsweet reached harvest maturity 90 days after planting.

Yields and average weight of fruits are presented in tables 8 and 9, respectively.

Table 8

Watermelon Yields, t/ha

Variety	I	II	III	Total	Total	Mean 1/
Sugar Baby	18.9	13.8	9.2	6.2	48.1	12.0 a
Allsweet	9.1	5.3	3.3	1.3	19.0	4.8 c
Charleston Gray	17.8	8.6	5.1	3.3	34.8	8.7 b

1/ Means with different letters are significant at 5% level.

Table 9

Average weight of marketable melons in kilograms

Variety	I	II	III	IV	Total	Mean 1/	
Sugar Baby	3.3	3.5	3.9	2.6	13.3	3.3	b
Allsweet	5.1	5.0	4.0	4.7	18.8	4.7	a
Charleston Gray	5.9	5.2	5.3	4.9	21.1	5.3	a

1/ Means with different letters are significant at 5% level.

A large number of fruits of Charleston Gray and Allsweet were made unusuable by Blossom-end rot, a physiological abnormality believed to be related to moisture and calcium supply in the soil.

VARIETY EVALUATION AND FERTILIZER RESPONSE STUDIES WITH CORN

A trial planting of sweet corn during the early part of 1983 indicated that sweet corn is a suitable crop for the agro-climatic conditions of American Samoa. No serious disease problems was encountered during the entire cropping period. Except for the birds that did some damage by pulling out the young seedlings and eating the germinating seeds, no other serious pest was observed.

Yield was satisfactory.

Two separate experiments were then conducted with sweet corn. The first was a variety evaluation trial and the second experiment was a fertilizer response trial.

Variety Evaluation Trial

Five varieties were considered for the study namely, Sugar Loaf, Golden Cross Bantam, Silver Queen, NK-75 and Honey Comb. Planting was done on 20-feet (6-1 in) rows spaced 3 feet (0.91 in.) apart. Hills were spaced two feet (0.61 in) apart. Two plants were grown per hill.

The treatments (varieties) were arranged in a randomized complete blocks design. Treatments were replicated three times.

Sixty five days from planting all the varieties were harvested. Results of yield (unhusked ears) comparisons are presented in Table 10. Highest yield was obtained from Silver Queen with estimated yield of 10.19 tons/ha. Honeycomb was the second highest yielder with 8.27 tons/ha.

Table 10

Marketable yield
(ears with husks)
tons/ha

Variety	Replication I	II	III	Mean	1/
Sugar Loaf	5.01	5.15	4.61	4.92	a
Golden Cross Bantam	3.12	6.50	5.70	5.11	a
Silver Queen	9.96	11.38	9.22	10.19	c
NK-75	5.96	5.42	3.52	4.97	a
Honey Comb	8.27	8.94	7.59	8.27	b

1/ Differences between means with different letters are significant at 1% level.

Fertilizer Response Trial With Sweet Corn

This experiment was conducted firstly to determine the response of sweet corn to varying levels of fertilizer and secondly to obtain information on the fertility status of the soil.

The organic matter content of the soil was approximately 5 per cent.

The fertilizer rates used were 0, 250, 500, 1,000 and 2,000 kg/ha of 12-6-18 equivalent to 0, 30, 60, 120 and 240 kg of N, 15, 30, 60 and 120 kg of P_2O5, 0, 45, 90, 180 and 360 kg K_2O.

Two corn varieties were used: Golden Cross Vantam and Jumbo Gold.

The experimental design was split-plot. Variety was the main plot and fertilizer rates, were the sub plots. There were three replications. Hill spacing was 2 feet (6 m) on ten-foot (3.0 M) rows spaced 3 feet (0.91 m) apart. Two plants were maintained per hill.

The plant height taken at tasseling is presented in table 11.

Table 11

Influence of variety and fertilizer rates on plant height, cm.

Variety	Fertilizer rate, kg/ha 0	250	500	1000	2000	Mean 1/
Golden Cross Bantam	130	174	180	185	180	170
Jumbo Gold	129	173	181	188	183	171
Mean	138[a]	174[b]	180[b]	186[b]	182[b]	

1/ Differences between means with different letters are significant at 1% level.

As shown in the table there is no difference in plant height between varieties. Fertilizer rate on the other had significant effect on height. Plants on the control plots were smaller than those plants that were applied with fertilizers.

The corn was harvested 63 days after planting. Results of yield evaluation in terms of weight of unhusked marketable ears are shown in table 13.

Table 12

Corn Yield as influenced by variety and fertilizer, T/ha

Variety	Fertilizer (12-6-18) rate, kg/ha 0	250	500	1000	2000	Mean 1/
Golden Cross Bantam	0.7	4.0	6.5	10.8	11.8	6.8
Jumbo Gold	1.0	7.3	11.4	13.8	13.4	9.4
Mean	0.8[a]	5.6[b]	9.0[bc]	12.3[c]	12.6[c]	

1/ Means with different letters are significantly different at 1% brel.

Yield between varieties did not differ significantly. Fertilizer rate on the other hand had significant effect on yields. Yields increased with increased rate of application. Yields of the control plots were almost neglible compared to the yields obtained at the highest rate of fertilizer application. From an economic view point, application of 500 kg per hectare of 12-6-18 appeared the most appropriate for corn in this particular area.

STUDIES WITH TARO (CALOCASIA ESCULENTA SCHOTT)

Taro is a staple food in American Samoa and other Polynesian Islands. In the old days, taro was considered as the staff life in Hawaii. Early Hawaiians lived chiefly on taro, sweet potatoes, fish seaweeds and a few vegetables (1).

There is a confusion in the classification of taro not only in the scientific name but in common names as well. What is referred to as taro in the Pacific is known as dasheen in the West Indies (3,5). This type of taro has a large corm with few small cormels. What is referred to as dasheen in the Pacific is popularly known as Eddoe in the West Indies. This type has a small corm often times iredible and with large edible cormels. There are lowland and upland varieties in the type.

The most commonly grown Type of taros in American Samoa are the upland Pacific taros or the West Indies Dasheen.

Effect Of Mechanical And Chemical Weeding On The Yield Of Taro

The effect of weed control on taro by mechanical weeding (using Troybuilt rototiller) and by the use of chemical herbicides - paraquat and roundup, was compared.

Manu'a variety was used in the experiment. Tiapula or petiole was used as the planting material. A planting stick or oso was used in planting the tiapula. Plant spacing was 3 x 3 feet. (0.91 x 0.91 m). Rows were 30 feet (9.1 m) long. There were five rows per treatment. The two outside rows, one in either side, were the guard rows.

Experimental design was randomized complete blocks with three replications.

Weed control treatments were started one month after planting. For the mechanical weeding, a Troybuilt rototiller was passed between the rows. Rototilling depth was adjusted at approximately 3-4 inches (7.6 - 10.2 cm). For better weed control, each row was rototilled two times. With the herbicide treatment, paraquat was applied at the rate of one table spoonful per 12 liters of water. Round-up was applied at the rate of two table spoonful per 12 liters of water.

Similar procedures were followed during the second and third weed control operations. The second weeding was done one and half months after the first and the third, one and one half months after the second. Before the second and third weeding operations were done, weeds growing in the area within a foot of the individual plant were pulled by hand.

... Results of the experiment also provided information on the fertility states of the soil in the area. The positive yield response to fertilizer rate and the stunted growth and deficiency symptoms exhibited by the plants on the control plots were indications of the low level of major nutrient elements in the soil particularly, that of nitrogen and potassium. ...

Some differences in growth between mechanically and chemically weeded plots were observed. Plants on chemically weeded plot were slightly taller and with slightly larger stems than those plants weeded mechanically.

Taro production under different methods of weeding is shown in Table 13.

Table 13

Marketable yield of taro as influenced by type of weedings, tons/ha.

Type of Weeding	I	II	III	Mean 1/
Paraquat	23.6	14.9	9.3	15.9
Roundup	23.2	13.8	10.4	15.8
Machine	20.4	13.2	5.0	12.9

1/ Differences among treatments are not significant.

Taro Variety Evaluation Trial

The yield performance of the two most commonly grown varieties of taro in American Samoa was evaluated. The varieties were Niue and Manu'a.

The experimented design was randomized complete blocks. The treatments (variety) were replicated four times. Tiapula or petioles were used as planting materials.

Distance of planting was 3 x 3 feet (0.91 m). Planting was done with a planting stick.

The plants were harvested approximately 6 months after planting. Harvesting was done by pulling the whole plant off the ground. Weight and number of marketable roots were taken.

Average weight of marketable roots for the two taro varieties is shown in table 14. It can be seen in the table that heavier or larger root were obtained from Manu'a variety. Statistical analyses also revealed that the difference in the weight of root production is statistically significant.

Table 14
Average weight corm in kilograms

Variety	Replication I	II	III	IV	Mean 1/
Niue	0.65	0.73	0.62	0.53	0.63 a
Manu'a	0.96	1.34	1.04	0.79	1.03 b

1/ Difference between means significant at 1% level.

Results on total yields are shown in Table 15. It can be seen that Manu'a variety on a hecture basis yielded 4 tons higher than Niue. The difference in yield can be attributed to the difference in the weight of the individual roots.

Table 15
Taro Production, tons/ha

Variety	I	II	III	IV	Mean
Niu'ē	7.7	8.7	9.0	6.3	8.0 a
Manu'a	11.4	16.0	12.3	10.1	12.4 b

1/ Difference between means is significant at 1% level.

Effect Of Distance Of Planting And Variety On Taro Production.

Manu'a and Niu'ē varieties were selected for the study. They were planted on June 21, 1984. Planting was done by means of a planting stick or oso. One table spoon of 12-6-18. Fertilizer was applied at the bottom of the planting hole.

Three different distances of planting were used: 2x2 feet (0.6m) 3x3 feet (0.9 m x 0.91 m) and 4x4 feet (1.2m x 1.2 m) Rows were 20 feet (6.1m). Each treatment had three rows. Data were taken from the middle row.

Experimental design was split plot. Variety was the main plot and distance of planting, the subplots. There were 3 replications.

The plants were harvested six months and 24 days after planting. Weight and number of roots (corms) were recorded. Data on the average weight of roots are presented in Table 16.

Table 16
Weight of roots as influenced by variety and distance of planting in Kilogram

Variety	Distance of planting in meter .6 x .6	0.9 x 0.9	1.2x1.2	Mean 1/
Niue	0.7	1.0	0.8	0.8
Manu'a	1.0	1.1	1.4	1.2
Mean	0.8	1.0	1.1	

1/ Differences between means are statistically insignificant.

Weight of roots or size seemed to increase with wider spacings. However, statistical analyses indicated that differences in root weight between spacing was not significant. Difference in root size between varieties on the other hand was found significant. Manu'a variety produced root significantly bigger or heavier than those of the Niue variety.

Data on total yields are shown in Table 17. Total yields increased significantly with decreased plant spacings. Lowest yields were obtained at 4x4 feet (1.2x1.2 m) spacing while the highest total yields were obtained at 2x2 feet (0.6 x 0.6 m) spacing.

Difference in yield between variety was found insignificant. It may however be noted that yields of Manu'a variety was relatively higher than those of the Niue variety.

Table 17
Yield of Taro as influenced by distance of planting and variety, tons/ha

Variety	Distance of Planting, ft. 2x2	3x3	4x4	total	Mean 1/
Manu'a	25.9	12.5	9.4	47.8	15.9
Niu'ē	18.9	12.2	5.3	36.4	12.1
Total	44.8	24.7	14.7		
Mean 1/	22.4[a]	12.4[b]	7.3[c]		

1/ Differences between means with different letters are significant

Appendix

LITERATURE CITED

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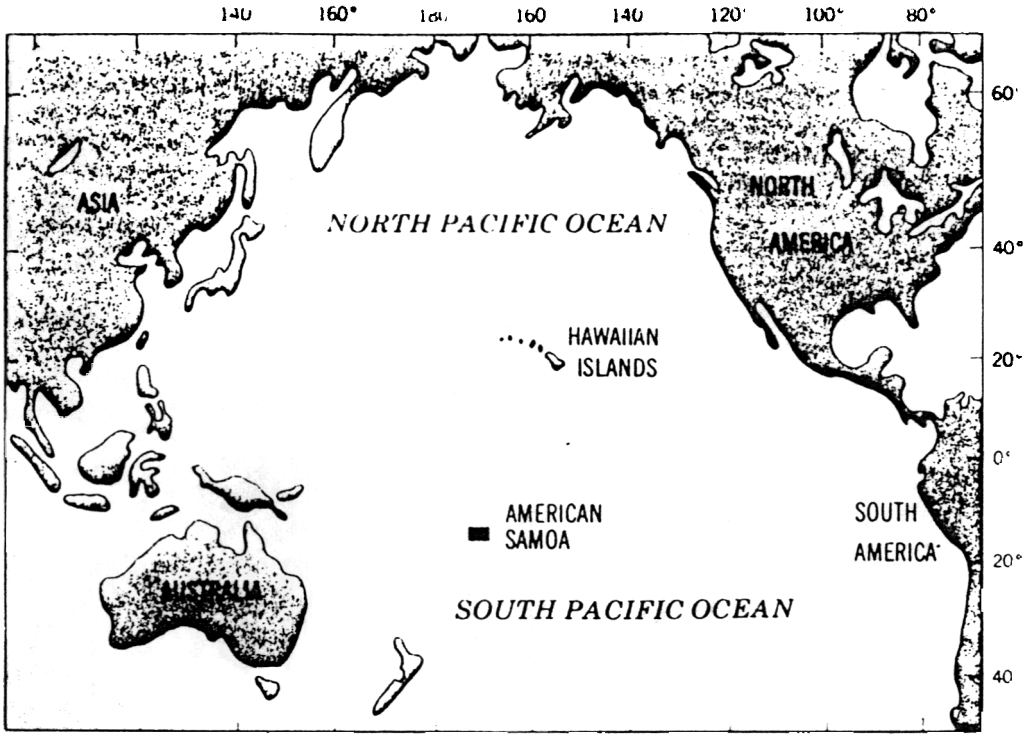
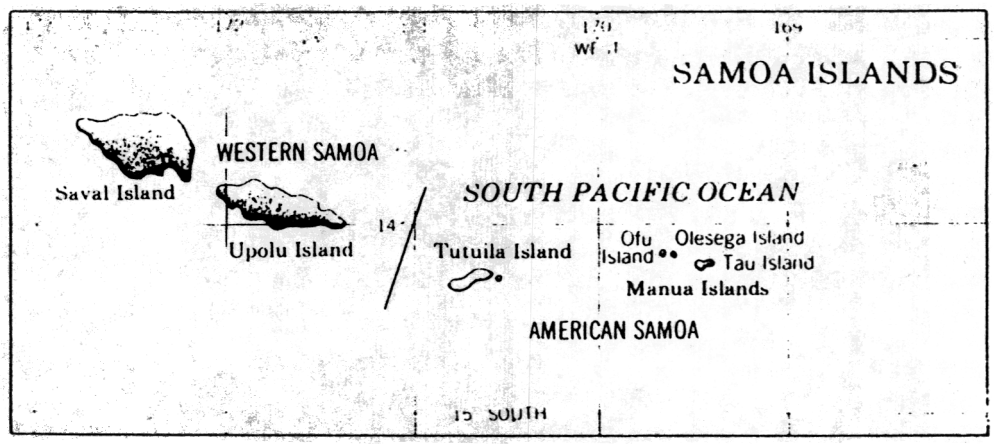
TABLE I — RAINFALL AND TEMPERATURE 1/

(Recorded at Pago Pago Airport. Rainfall was recorded in the period 1960-80. Temperature was recorded in the period 1964-66)

	Mean monthly rainfall	Temperature		
		Mean daily	Maximum daily	Minimum daily
	Cm	°C	°C	°C
January	32.59	27.1	30.4	23.8
February	30.20	27.1	30.4	23.8
March	29.90	27.2	30.6	23.8
April	30.23	27.1	30.3	23.7
May	28.35	26.6	29.6	23.6
June	20.17	26.4	29.1	23.8
July	17.20	26.0	28.6	23.4
August	18.69	29.9	28.6	23.3
September	16.97	26.3	29.2	23.4
October	28.88	26.6	29.4	23.8
November	28.12	26.9	29.8	23.9
December	35.56	27.0	30.1	23.9
Annual	316.84	27.0	29.7	23.7

1/ Reprinted from soil survey of American Samoa, Soil Conservation Service USDA, 1984.





Location of American Samoa in the South Pacific.