

## **YIELD AND FERTILIZER STUDY ON CREEPING SITAO AND AUSTRALIAN BUSH SITAO**

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Sitao (*Vigna senensis* var. *sesquipedalis* Frund), a sub-species of cowpea (*Vigna sinensi*), is probably the most widely grown vegetable of podded legume family in the Philippines. Because it is proteinous, it has gained popularity as "Poor man's meat" (PIL, 1968).

Seasons affect sitao, which gives a higher yield when planted in November than in January (Empig and Aday, 1963). The response of different sitao varieties to weather varies greatly, according to Zaumeyer (1964). Knott and Deanon (1967) pointed out that sitao can be grown throughout the year, but its yield is better when planted in May to June for the wet season crop and October to November for dry season crop than in other months of the year.

Beans grow well on a wide variety of soils, from light sand to heavy clay. However, they are quite sensitive to extremely acid soils and to those with high concentration of soluble aluminum and manganese (Forsee and Hoffman, 1950). Beans, like other short season vegetable crops, need nutrients — nitrogen, phosphoric acid and potash — in the more readily available forms for growth and development. Therefore, fertilizer application is recommended. Although legumes have bacteria in their nodules that can fix free nitrogen, the relatively long time it takes to fix the nitrogen (the process is known as nodulation) may result in nitrogen hunger.

### **The Project Setting**

Marawi City has a cool climate, with a monthly mean temperature range of 16.2°C in January and 27.25°C in April and a relative humidity of 81 per cent to 91 per cent. Its annual rainfall is 120 inches,

almost evenly distributed throughout the year. Effective bright sunlight lasts an average of 6.75 hours a day in monthly mean (Table 1) and 46.25 per cent average monthly bright sunlight.

Table 1 – Some Basic Climatic Record Taken from MSU PILOT AGRO-MET Station from July 1969 – June 1970 in monthly mean.

Months	Temperature °C		Solar Radiation		Rainfall (mm)	Relative humidity (%)
	Max.	Min.	No. of Hours bright sunlight	% of bright sunlight		
January	24.95	16.20	7.0	49.00	161.50	91.0
February	24.75	18.50	6.5	44.50	222.00	90.5
March	26.85	19.85	6.5	42.25	183.90	80.5
April	27.25	22.30	7.5	60.50	202.50	84.0
May	26.30	20.05	7.0	50.00	305.15	85.0
June	25.80	20.50	6.0	44.00	310.10	85.0
July	26.20	20.35	7.0	50.00	420.80	82.0
August	26.70	19.35	8.0	61.00	359.80	82.0
September	26.45	19.50	5.5	31.50	221.90	87.5
October	27.05	19.35	7.5	54.50	244.00	84.0
November	26.25	19.15	6.0	46.00	232.3	86.0
December	25.95	19.95	7.0	48.00	222.00	89.0
Average	26.00	19.25	6.75	46.25	302.25	85.75

The city's culture – the Maranao – look down on vegetable growing as a lower class type of farming than rice or corn growing.<sup>1</sup> Thus it is not surprising to note that while the area is suited for vegetable production, vegetables, especially beans, are hardly grown at all. Yet a high protein crop like legumes can be grown to supplement the city's protein needs which are scantily met by animal and fish protein generally priced out of the reach of common people.

To help meet the people's dietary needs, the College of Agriculture of Mindanao State University took steps to acquire adaptive species of beans. In that quest, two varieties were tested for adaptability – the Australian bush sitao<sup>2</sup> and the creeping sitao.

The Australian bush sitao, also called snake bean, is similar to the Los Baños bush sitao in feature and taste but differs in pod and seed

color. The snake bean pod is creamy white and is adapted to high elevation, while the Los Baños variety cannot thrive at high elevation.

The Australian bush sitao drew interest because of its high yield and resistance to serious pests and diseases in the area where it was continuously grown for three years. During that period, no attempt was made to control pests and diseases. After three years, it was grown with the creeping sitao – which was selected from local beans introduced earlier on campus. The creeping sitao is also high yielding, palatable and resistant to pests and diseases. Various kind of fertilizers were used for both varieties.

### Land Preparation

The experimental area of the MSU College of Agriculture has a slope of less than one per cent. It was formerly planted to corn. It was cultivated thoroughly by a hand cultivator that simulated a gardener three weeks before planting. Three soil samples, each from a different site, were chemically analyzed (Table 2).

Table 2 – SOIL ANALYSIS

Samples	Soil Types	Texture	Percentage Organic Matter (%)	PH	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
I	Adtuyon clay loam	Heavy	3.5	6.2	5	48
II	Adtuyon clay loam	Heavy	4.5	6.2	8	108
III	Adtuyon clay loam	Heavy	4.5	6.2	8	70

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### Trials

The two sitao varieties were given two trials – the first trial (February 2, 1972) was for dry season, and the second trial (May 25, 1972) for wet season, They were given the same amount of fertilizers – ammonium sulphate 21 per cent; nitrogen, superphosphate 20 per cent P<sub>2</sub>O<sub>5</sub>, muriate of potash 60 per cent K<sub>2</sub>O agricultural lime, and chicken dung, singly and combined (Table 3). These fertilizers are not found in the area, nor are within the reach of people.

Table 3 – RATE OF FERTILIZATION

Fertilizers	Kg./Ha.	Gram/plot (2m <sup>2</sup> )
1. 21-0-0	250	50
2. 0-20-0	500	100
3. 0-0-60	100	20
4. Lime	500	100
5. Chicken Dung	1000	200
6. 0-20-0 & Dung	1500	300
7. 71-20-0	750	150
8. 21-20-60	850	170
9. 21-20-60 & Dung	1850	370
10. Control	0	0

The seeds were planted in plots 1 m x 2 m in size, four plots per trial. Distance between plots was 50 centimeters.

Additional two trials on spacing and a single trial on weed study were made. The spacing trials for the two varieties were done during the dry season only. The weed trial was made during wet season, using bush sitao as the test species. In the spacing trials, the N-P-K fertilizer (12-24-12) were used at the rate of 500 kg. per hectare, while in the weed experiment, chicken dung was added to the soil at the rate of 1000 kg. per hectare – which was evenly applied on the entire plot two weeks before planting. The inorganic fertilizers, including lime, were applied a week after germination or two weeks after seeding in a ring method. Lime was spread evenly on the plot where it was intended to be applied.

#### Rate of Seeding and Spacing

The seeds were sown four to a hill, and spaced 50 cm. x 50 cm., except in the spacing study where spacing was the variable. They were thinned out to two seedlings per hill two weeks from seeding.

#### Cultivation and Weeding

Weeds were always kept at a minimum by regular hand weeding. But hilling was done only once so as not to disturb the crops.

## Control of Pests and Diseases

A daily watch over pest infestation was also made. When they showed signs of infestation, the plants were immediately sprayed with Malathion, alternated with Macthion and Thiodan, at the rates recommended by their manufacturers. Occasionally, these sprays were mixed with Cuprox or Karathane to prevent fungal diseases.

## Recording of Data

The plant height – based on primary leaves – was measured at flowering stage and at every treatment in all trials. Similarly, sample weight and length per pod were recorded during the first and last harvest. On harvest, the green pod yields per plot, were weighed and for the month's harvest were consolidated for statistical analysis. In the spacing studies, counting of pod sets during the first fruiting was also done in addition to other data recording.

## Results

The Australian bush sitao was harvested in 70 days while the creeping sitao was harvested in 75 days. Harvesting commenced when the pods were already swollen.

In the dry season trial, the bush sitao, when given phosphorous, produced 8.96 kg /plot or 44,800 kg /ha of green pods. When given nitrogen and phosphorous, it had a yield of 8.45 kg /plot or 42,250 kg /ha but when only chicken dung was applied, its yield dipped to 7.44 kg /plot or 37,200 kg /ha. Its main yield was 8.05 kg /plot or 40,250 kg per hectare. No significant differences in yields (Table 4) due to application of various fertilizers was noted.

In contrast, creeping sitao, fertilized with chicken dung, produced its highest yield of 8.32 kg /plot or 41,600 kg /ha. Like the bush sitao, its second highest yield – 8.21 kg /plot or 41,050 kg /ha. – resulted from its being given nitrogen and phosphorus. When given dung and complete fertilizer combination, its yield dropped to 7.09 kg /plot or 35,450 kg /ha. Its mean yield of 7.76 kg /plot or 38,800 kg /ha is slightly lower than the bush sitao's. Again, it was noted (Table 4) that no significant differences were produced by the various fertilizer treatments.

**Table 4 – Effect of Yield on Bush and Creeping Sitao Fertilized with Various Kind of Fertilizer during Dry Season Trial.**

Fertilizers	BUSH SITAO		CREEPING SITAO	
	Yield per plot (kgm)	Yield per ha (kgm)	Yield per plot	Yield per hectare
1. Control	7.82	39,100	7.50	37,500
2. 21-20-0	8.08	40,400	7.95	39,750
3. 0-20-C	8.96	44,800	7.64	38,200
4. 0-0-60	7.70	38,500	7.88	39,400
5. Lime	8.14	40,200	7.75	38,750
6. Chicken Dung	7.44	37,200	8.32	42,600
7. Dung + 0-20-0	7.49	37,450	7.88	39,400
8. 21-20-0	8.45	42,250	8.21	41,050
9. 21-20-60	8.08	40,400	7.35	36,750
10. Dung + 21-20-60	8.19	40,950	7.09	35,450
Mean	8.05	40,250	7.76	38,800
F-Test	.93 (NS)		1.05 (NS)	

The experiment showed that bush sitao has a higher yield than the creeping sitao in dry season, although their differences are not sharp (Table 5). The greater difference was in the time it took to produce similar quantities of green pods. For the Australian bush sitao, its productive life was only three months (Table 6) whereas for the creeping sitao, its productive life extended to five months – or two months longer than the bush sitao's (Table 7).

The different fertilizers, either applied singly or combined, did not radically influence the length and weight per pod of both varieties (See Table 8).

### Rainy Season Trial

The yield of both the Australian bush sitao and creeping sitao sharply dropped in the wet season trial. Whereas in the dry season test, bush sitao at best produced 8.96 kg /plot, in wet season trial, it produced only 1.42 kg /plot or 7,050 kg /ha, an 84 per cent reduction in yield. Bush sitao when fertilized with nitrogen and dung, either applied singly or in combination, produced a better yield than without them (Table 9). It seems that nitrogen and dung helped produce a better

**Table 5 – Comparative T-test on Green pod yield of two varieties fertilized with various kinds of fertilizers during dry season trial.**

GREEN POD YIELD PER PLOT				
Fertilizers	Bush Sitao (X <sub>1</sub> )	Creeping Sitao (X <sub>2</sub> )	Difference between means (d)	d <sup>2</sup>
1. 21-0-0	8.08	7.95	0.13	.0169
2. 0-20-0	8.96	7.64	1.32	1.7424
3. 0-0-60	7.70	7.88	-0.18	.0324
4. Lime	8.14	7.75	.39	.1521
5. Chicken Dung	7.44	8.32	-0.88	.7744
6. Dung + 0-20-0	7.49	7.88	-0.39	.1521
7. 21-20-0	8.45	8.21	0.24	.0576
8. 21-20-60	8.08	7.35	.73	.5329
9. Dung + 21-20-60	8.19	7.09	1.10	1.2100
10. Control	7.82	7.50	-0.32	.1024

$$t = 2.08 \text{ N.S. } Z d \ 3.91 \ Z d^2 \ 4.7732$$

**Table 6 – Monthly and total mean Green pod yield of Bush Sitao in kgm./plot fertilized with various kind of fertilizers during dry season trial.**

Treatments	M O N T H S			Total
	April	May	June	
1. Control	4.38	1.67	0.77	7.82
2. 21-0-0	4.59	2.72	0.77	8.08
3. 0-20-0	5.26	2.94	0.76	8.96
4. 0-0-60	4.52	2.42	0.76	7.70
5. Lime	4.64	2.76	0.74	8.14
6. Chicken Dung	4.06	2.52	0.86	7.44
7. 0-20-0 + Dung	3.99	2.62	0.88	7.49
8. 21-20-0	5.09	2.68	6.68	8.45
9. 21-20-60	4.51	2.79	0.78	8.08
10. 21-20-60 + Dung	4.71	2.75	0.73	8.19

**Table 7 – Monthly and total mean Green Pod yield of Creeping Sitao in kgm. per plot fertilized with various kind of fertilizers during dry season trial.**

	M O N T H S					Total
	April	May	June	July	August	
1. Control	2.06	3.41	0.91	0.61	0.51	7.50
2. 21-0-0	2.50	3.04	0.91	1.04	0.46	7.95
3. 0-20-0	1.98	3.43	1.01	0.77	0.45	7.64
4. 0-0-60	2.32	3.00	1.08	1.07	0.41	7.88
5. Lime	2.15	2.98	1.12	1.04	0.46	7.75
6. Chicken Dung	2.12	3.55	1.20	0.89	0.56	8.32
7. Dung + 0-20-0	2.33	3.30	1.01	0.64	0.60	7.88
8. 21-20-0	2.52	2.30	1.00	1.02	0.47	8.21
9. 21-20-60	2.17	3.20	0.76	0.85	0.37	7.35
10. Dung + 21-20-60	1.98	3.14	0.81	0.69	0.47	7.09

bush sitao yield during wet season. The plots, which received only lime, had the lowest yield or 0.73 kg./plot or 3,600 kg./ha. The bush sitao's

**Table 8 – The length and weight per pod of Bush and Creeping Sitao fertilized with various kind of fertilizers during dry season trial.**

	BUSH SITAO		CREEPING SITAO	
	Length per pod (cm)	Weight per pod (gm)	Length per pod (cm)	Weight per pod (gm)
1. Control	30.73	14.98	35.35	12.55
2. 21-0-0	30.87	17.01	35.58	12.80
3. 0-20-0	31.73	15.01	35.50	12.68
4. 0-0-60	31.63	16.28	34.75	12.80
5. Lime	29.40	15.40	34.50	13.08
6. Chicken Dung	30.65	15.16	34.93	13.05
7. Dung + 0-20-0	29.80	14.32	33.70	13.28
8. 21-20-0	30.63	14.80	35.05	13.15
9. 21-20-60	29.50	15.52	34.50	13.38
10. Dung + 21-20-60	31.63	15.52	35.23	12.48
Mean	30.67	15.40	34.09	12.25
F-Test	N.S.	N.S.	N.S.	N.S.

mean yield in wet season was only to 1.08 kg /plot or 5,400 kg /ha. Statistical analysis, which indicated a very high significant difference (HSD) test on mean, failed to indicate a superior treatment; it merely produced two groupings: Plots applied with dung and nitrogen fertilizers, either applied singly or in combination with phosphorous, and plots applied with phosphorous-potassium, constitute the upper group, while the rest of the treatments constitute the lower group.

The creeping sitao fared better than the bush sitao in the wet season trial (Table 9). It showed best when fertilized with nitrogen-phosphorous combination – its yield was 1.80 kg /plot or 9,000 kg /hectare. Still, its yield dropped by 78 per cent. Plots that received only phosphorous obtained the lowest yield – 1.13 kg /plot or 5,650 kg /ha. Statistical analysis showed a very highly significant level in F-test and like the bush sitao, the test in mean yield difference formed into two groups – treatments with nitrogen and dung, either applied singly and in combination, constitute the upper group; other treatments comprise the lower group.

**Table 9 – Yield of Bush and Creeping Sitao Fertilized with various kind of fertilizers during wet season trial.**

Fertilizers	BUSH SITAO		CREEPING SITAO	
	Yield per plot (kgm)	Yield per ha (kgm)	Yield per plot (kgm)	Yield per ha (kgm)
1. Control	0.84	4,200	1.14	5,700
2. 21-0-0	1.36	6,800	1.60	8,000
3. 0-20-0	0.92	4,100	1.13	5,650
4. 0-0-60	0.83	4,150	1.22	6,100
5. Lime	0.73	3,650	1.24	6,200
6. Chicken Dung	1.18	5,900	1.63	8,150
7. Dung + 0-20-0	1.07	5,350	1.54	7,700
8. 21-20-0	1.35	6,750	1.80	9,000
9. 21-20-60	1.41	7,050	1.69	8,450
10. Dung + 21-20-60				
Mean	1.08	5,400	1.46	7,300
F-test	11.00		36	
HSD	0.36		0.19	

The comparative t-tests (Table 10) of the two varieties show that creeping sitao fares better than bush sitao during wet season. Unlike in the dry season, both varieties have only a two-month productive life in wet season (Table 11 and 12).

Table 10 — Comparative Test on total Green Pod yield of two varieties fertilized with various kinds of fertilizers (wet season trial)

Fertilizers	GREEN POD YIELD IN KGM. PER PLOT			
	Creeping Sitao ( $X_1$ )	Bush Sitao ( $X_2$ )	Difference bet. means ( $d$ )	( $d^2$ )
1. Control	1.14	0.84	0.30	0.0900
2. 21-0-0	1.60	1.36	0.24	0.0576
3. 0-20-0	1.13	0.92	0.21	0.0441
4. 0-0-60	1.22	0.83	0.39	0.1521
5. Lime	1.24	0.73	0.51	0.2601
6. Chicken Dung	1.63	1.18	0.45	0.2025
7. 0-20-0 + Dung	1.54	1.07	0.47	0.2209
8. 21-20-0	1.80	1.35	0.45	0.2025
9. 21-20-60	1.69	1.41	0.28	.0784
10. Dung + 21-20-60	1.60	1.18	0.42	0.1764
	$t = 11.27$		$Zd = 3.72$	$Zd^2 = 1.4846$

Table 11 — Monthly Total Mean Green Pod yield of Bush Sitao in kgm. per plot fertilized with various kinds of fertilizers during wet season trial.

Fertilizers	M O N T H S		
	July	August	Total
1. Control	0.63	0.21	.84
2. 21-0-0	1.12	0.24	1.36
3. 0-20-0	0.67	0.25	.92
4. 0-0-60	0.59	0.24	.83
5. Lime	0.54	0.19	.73
6. Chicken Dung	0.59	0.59	1.18
7. Dung + 0-20-0	0.49	0.58	1.07
8. 21-20-0	1.12	0.23	1.35
9. 21-20-60	1.16	0.25	1.41
10. Dung + 21-20-60	0.61	0.57	1.18

The pod of both varieties was longer in the wet season trial than in the dry season test (Tables 13 and 14). But their weight changes differed. Whereas bush sitao's mean weight per pod decreased slightly in the wet season, from 15.40 gm. to 15.06 gm., the mean weight of creeping sitao increased by 2.18 grams (Table 14).

**Table 12 – Monthly and Total Mean of Green Pod Yield of Creeping Sitao in Kgm. per Plot Fertilized with various kind of fertilizers during wet season trial.**

Fertilizers	M O N T H S		
	July	August	Total
1. Control	0.43	0.71	1.14
2. 21-0-0	0.77	0.85	1.60
3. 0-20-0	0.52	0.61	1.13
4. 0-0-60	0.51	0.71	0.22
5. Lime	0.49	0.75	1.24
6. Chicken Dung	0.11	1.52	1.63
7. Dung + 0-20-0	0.24	1.30	1.54
8. 21-20-0	0.97	0.83	1.80
9. 21-20-60	0.99	0.70	1.69
10. Dung + 21-20-60	0.04	1.56	1.60

### Effects of Spacing on Yield

Spacing has an influence on yield – the closer the distance of plants, the better the yield. This is only true when the increase in yield fails to offset the greater seed cost and other expenses connected with culture (Knott and Deanon, 1967).

In the trial, spacing of 25 cm. x 25 cm. yielded the highest for both varieties (Table 15). Spacing 25 cm. x 50 cm. and 50 cm. x 50 cm. produced the same yield although lower than the 25 cm. x 25 cm. spacing, for bush sitao. The lowest production was at 50 cm. x 100 cm. spacing. The t-tests indicate a very highly significant result and HSD test shows a significantly higher mean yield for the plot space 25 cm. x 25 cm. than those spaced 25 cm. x 50 cm. and 50 cm. x 50 cm. The yield in plots with 50 cm. x 50 cm. spacing also differs significantly

Table 13 – Length and Weight per Pod of Bush and Creeping Sitao Fertilized with various kind of fertilizers during wet season trial.

Fertilizers	BUSH SITAO		CREEPING SITAO	
	Length per pod (cm)	Weight per pod (gm)	Length per pod (cm)	Weight per pod (gm)
1. Control	32.79	14.88	37.65	13.70
2. 21-0-0	33.20	14.28	38.70	13.36
3. 0-20-0	32.00	13.50	40.47	14.86
4. 0-0-60	33.03	14.39	41.85	14.62
5. Lime	32.45	13.42	40.10	14.23
6. Dung	36.81	17.89	39.09	14.12
7. Dung + 0-20-0	35.03	16.00	40.30	15.28
8. 21-20-0	32.88	15.12	41.80	14.67
9. 21-20-60	32.85	14.12	40.80	14.76
10. Dung + 21-20-60	35.49	15.78	41.60	14.56
Mean	33.65	15.06	40.24	14.43
F-test	N.S.	N.S.	N.S.	N.S.

Table 14 – The Differences in Mean Length and Pod of Bush Sitao and Creeping Sitao produced during wet and dry season.

Season	BUSH SITAO		CREEPING SITAO	
	Mean Length per pod (cm)	Mean Weight per pod (gm)	Mean Length per pod (cm)	Mean Weight per pod (gm)
Wet Season	33.65	15.06	40.24	14.43
Dry Season	30.67	15.40	34.09	12.25
Difference	2.98	-.36	5.15	2.18

from those with 50 cm. x 100 cm. spacing. It appears that the 50 cm. x 50 cm. spacing is the optimum for the bush sitao.

The creeping sitao on the other hand showed a gradual yield decrease the further apart the spacing. However, its statistical analysis (Table 15) reveals no significant differences on yield per plot.

Spacing did not affect significantly the height, length of pod and weight of pod of both varieties (Tables 16 and 18), but markedly

(Table 15) reveals no significant differences on yield per plot.

**Table 15 – Yield of Bush Sitao and Creeping Sitao Planted at various spacing per plot and hectare.**

SPACING	BUSH SITAO		CREEPING SITAO	
	Yield per plot (kg)	Yield per ha (kg)	Yield per plot (kg)	Yield per ha (kg)
1. 25 x 25 cm	6.44	42,933	5.86	39,067
2. 25 x 50 cm	5.62	37,467	5.18	34,533
3. 50 x 50 cm	5.61	37,400	4.75	31,667
4. 50 x 100 cm	4.96	33,067	4.70	31,333
Mean	5.66	37.773	5.12	34,133
F-Test	18.75		0.71(N.S.)	
HSD	0.62			

affected the number of pod sets per plant (Tables 17 and 19). The number of pod sets of bush sitao increased sharply in 25 cm x 25 cm and 25 cm x 50 cm spacing and slightly in 50 cm x 50 cm and 50 cm x 100 cm spacings (Fig. 1). In the creeping sitao, the number of pod sets sharply increased in the 25 cm x 25 cm, 25 cm x 50 cm and 50 cm x 50 cm spacings, tapering off in the 50 cm x 100 cm spacings (Fig. 1). Statistical analysis of both varieties shows significant differences on F. test (Tables 17 and 19). The HSD test reveals no significant difference on creeping sitao, while it shows significant results on bush sitao spaced 25 cm x 25 cm and 50 cm x 50 cm but no significant difference on it spaced 25 cm x 50 cm and 50 cm x 100 cm.

**Table 16 – Height, Length and Weight per Pod of Bush Sitao planted at various spacing.**

Spacing	Height (cm) at flowering stage	Length per pod (cm)	Height per pod (gm)
1. 25 x 25 cm	32.95	33.22	16.81
2. 25 x 50 cm	32.48	33.88	18.54
3. 50 x 50 cm	30.05	34.93	19.54
4. 50 x 100 cm	29.75	34.99	19.26
F-Test	N.S.	(N.S.)	1.59 (N.S.)

Table 17 – Number of Pods set per plant of Bush Sitao planted at various spacing during the first fruit setting.

S p a c i n g	B L O C K				Total	Means
	I	II	III	IV		
1. 25 x 25 cm	14.4	11.0	10.1	14.3	49.80	12.45
2. 25 x 50 cm	18.9	15.4	18.1	16.1	68.50	17.13
3. 50 x 50 cm	24.2	21.8	18.9	23.2	88.10	22.03
4. 50 x 100 cm	27.7	19.9	25.2	23.0	95.80	23.95
Mean	21.30	17.03	18.08	19.15		
					F-Test	30.23
					HSD	4.16

Table 18 – Height, Length and Weight per Pod of Creeping Sitao Planted at various spacing.

S p a c i n g	Height (cm)	Length per pod (cm)	Weight per pod (gm)
1. 25 x 25 cm	34.70	29.25	12.10
2. 25 x 50 cm	33.94	28.73	11.42
3. 50 x 50 cm	32.78	28.54	12.40
4. 50 x 100 cm	31.50	28.96	12.64
F-Test	N.S.	N.S.	N.S.

Table 19 – Number of Pods set per plant of Creeping Sitao planted at various spacing based on first set of fruiting.

S p a c i n g	B L O C K			Total	Mean
	I	II	III		
1. 25 x 25 cm.	10.0	17.7	15.0	42.70	14.23
2. 25 x 50 cm.	22.4	17.2	18.8	58.40	19.47
3. 50 x 50 cm.	29.6	29.2	27.8	86.40	28.80
4. 50 x 100 cm.	24.9	31.3	33.40	89.60	29.87
Mean	21.73	23.80	23.75		
				F-Test	13.72
				HSD	9.95

### Effects of Weeds on Yield

Observations have shown that yield is inversely proportional to the number of weeds present in the field (Knott and Deanon, 1967). The weed experiment run in the wet season with bush sitao as a test species showed that yield in unweeded plot decreased linearly until the 8th week when weeding was done (Table 21).

From then on, the reduction was minimal. The percentage of yield loss due to weeds was (Table 20) about 62 per cent of yield, gradually decreasing as the frequency of weeding was increased and tapering off in the 8th week. The experiment tends to show that bush sitao need be weeded until the 8th week to minimize loses. Beyond the 8th week, weeds have no more adverse effect on yield.

Table 20 – Percentage Reduction of Yield of Bush Sitao at various intervals of weeding

Weeding	Yield/plot	Estimated % retained	Estimated % Losses due to Weeds
1. No weeding	0.50	38	62
2. Weeding until 4th week	0.76	58	42
3. Weeding until 6th week	1.03	79	21
4. Weeding until 8th week	1.25	96	4
5. Weeding until 10th week	1.30	100	—
6. Weeded throughout	1.29	100	—

Table 21 – Effect on Yield of Bush Sitao in Kg./Plot weeded at various weekly intervals

	R E P L I C A T E					
	I	II	III	IV	Total	Mean
1. No weeding	0.14	0.90	0.47	0.49	2.00	0.50
2. Weeded until 4th	0.47	0.72	1.11	0.75	3.05	0.76
3. Weeded until 6th	0.66	0.82	1.69	0.96	4.13	1.03
4. Weeded until 8th	0.97	1.29	1.36	1.38	5.00	1.25
5. Weeded until 10th	0.88	1.26	1.24	1.83	5.21	1.30
6. Weeded throughout	0.87	1.35	1.39	1.53	5.14	1.29
Mean	0.67	1.06	1.21	1.16		
F-Test						7.32
HSD						0.52

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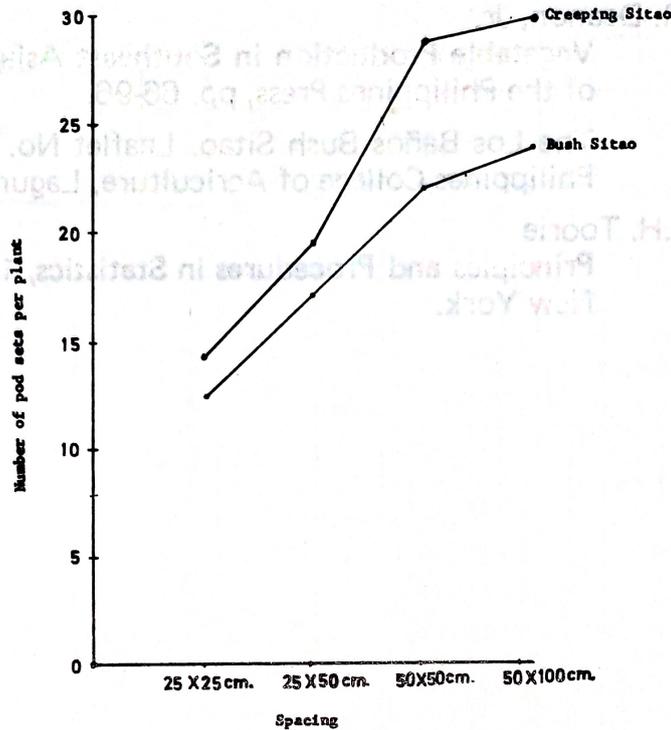


Fig. 1. Number of pod sets per plant of two varieties planted at various spacing

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