



DEPARTMENT OF AGRICULTURE  
BUREAU OF PLANT INDUSTRY

# BUSH SITAO

## PRODUCTION GUIDE



## Table of Contents

Title		Page
Cover Page		i
Table of Contents		ii
List of Tables		iii
List of Figures		iii
The BUSH SITAO Plant		1
Crop Varieties		1
Culture and Management		1
Soil and climate requirement		1
Land Preparation		2
Varietal Selection		2
Planting		2
Fertilization		2
Organic fertilizer		2
Weeding and Cultivation		2
Pest and Disease Management		3
Harvesting		4
Post Harvest Handling		4
Packing		5
Seed Production		5
References		8

### List of Tables

Table No.	Title		Page
1	Insect management in bush sitao		3
2	Disease management in bush sitao		4
3	Cost and Return Analysis of bush sitao per hectare (seeds)		6
4	Cost and Return Analysis of Bush sitao per hectare (fresh pods)		7

### List of Figures

Table No.	Title		Page
1	PSB-Bs #3		1

## The BUSH SITAO Plant

Bush sitao (*Vigna sesquipedalis* x *Vigna unguiculata*) belongs to the Fabaceae family. The crop is still minor in the Philippines since being planted only in small scale farming and in the backyards. Bush sitao is often times grown either as an intercrop or in rotation with other upland crops. Based from the production data of the Bureau of Agricultural Statistics (BAS), about 11,381 hectares were utilized for vegetable legume crops including bush sitao in 1995 with estimated production of 29,058 metric tons.

It is a cross between pole sitao and cowpea which possesses the combined good qualities of the two. The crop is bush-type, doesn't need a trellis, less susceptible to wind damage and easier to manage than pole sitao. This crop provides income to farmer when sold on open market.

Bush sitao is an annual dry season crop and takes a short period of time to grow. It may be erect, trailing, climbing, and usually indeterminate under favorable conditions. The leaves are trifoliate and are usually green in color. It is a self-pollinating crop. Flower colors are white, dirty white, pink, pale blue or purple. Flowers open in the morning and close in mid-day and after blooming they wilt and collapse. The stems are straight, smooth or slightly hairy and sometimes tinged with purple. The pods are borne above the leaf canopy making the pods very visible. The seeds vary in size, color and shape. Usually the number of seeds per pod varies from 8-20 seeds. The pods may be erect, crescent-shaped or slightly curved.

It is an important crop among home gardeners and has been released as substitute for pole sitao. It is a fast growing crop, bears more pods that are more tender and fleshy. It matures earlier and can be grown the whole year round. The plant tolerate drought, performs well in any type of soil however, friable fertile soil is preferred to obtain healthy growth and high quality pods.

Bush sitao is also a good source of plant protein and consumed as vegetables either cooked or mixed with other foods. It is also utilized as green manure to improve soil conditions. It is also a good source of feeds in the form of silage or forage.

## CROP VARIETIES

Among the open pollinated varieties of bush sitao are BPI-Bs #1, BPI-Bs #2 and PSB-Bs #3 (Figure 1). PSB-Bs #3 is recommended for its good pod quality, light green color, longer pod length (24.4cm), early maturing and has an average yield of 8.96 t/ha. This variety is also moderately resistant to pests and diseases. This variety is available at BPI-LBNCRDC.



Figure 1. PSB-Bs #3

## CULTURE AND MANAGEMENT

1. **Soil and climate requirement.** Bush sitao thrives in areas with fertile and well drained sandy loam soil. It is a warm season crop and can be grown throughout the year provided water is available. During dry season, weekly irrigation is recommended but water logging must be avoided during wet season because it induces pod rotting and causes root rot.



2. **Land Preparation.** Thorough land preparation is important to obtain high yield since the operation renders the soil ideal for seed germination resulting to high plant stand and will ensure healthy and uniform growth of bush sitao crop.

Prepare the land by alternately plowing and harrowing the field 2-3 times. The use of beds is recommended during the rainy season; however furrow method is still preferred because bedding is laborious. During dry season planting, prepare the furrows 60cm apart and 75cm for wet season because this crop becomes viny during this season.



3. **Varietal Selection** – Planting right varieties adapted to a specific area may increase yield by as much as 20%. In the varietal selection, there are important considerations to look into:

- Adaptability to soil and climate
- Maturity
- Yield
- Disease resistance and insect tolerance
- Market/consumers demand



4. **Planting.** Bush sitao can be planted the whole year round. Provided irrigation is available, better performance of the crop is observed when grown in January. The seeds are directly sown in the furrows. One hectare requires 10-12 kg of seeds. Drill the seeds in furrows at the rate of 15-20 seeds per linear meter. Thin out the seedlings 10 days after emergence.

5. **Fertilization.** Before the first plowing, apply 3 tons of well decomposed manure per hectare. Before planting, apply 3 bags/ha of 14-14-14 as basal fertilizer and side dress with 1-2

bags of urea (46-0-0) at 1 month after planting. Muriate of potash (0-0-60) should be applied at the rate of 1-2 bags during flowering stage. Foliar fertilizer should also be applied weekly, starting at flowering stage.

6. **Organic fertilizer:** Fertilizer should be bio-degradable materials of microbial, plant or animal origins produced on organic farms such as vermicompost and processed chicken manure. Basal applications of organic compost of 5-10 tons/ha are needed for vegetable legume crops. Supplementary application of Fermented Plant Juice (FPJ) or Fermented Fruit Juice (FFJ) should also be applied twice a week up to flowering stage.

7. **Weeding and Cultivation.** Off-baring and hilling-up can be done as early as two (2) weeks. Hand weeding shall be done as often as necessary. Even after flowering, spot weeding is still of much benefit to the crop. The common methods are hand pulling, hoeing and the use of animal-drawn native plow. Best results are achieved by using a combination of these methods.







8. **Irrigation.** The field should be irrigated right after planting or whenever necessary using manual watering to have a uniform germination of seeds. During dry season, weekly irrigation is recommended. Adequate application of water is necessary during flowering



and early fruiting stages to obtain high percentage of pod setting.

## PEST AND DISEASE MANAGEMENT

Table 1. Insect management in bush sitao

Insect Pest	Characteristic/Damage Done	Management
<b>Aphids</b> ( <i>Aphis gossypii</i> ) 	<ul style="list-style-type: none"> <li>- aphids suck sap on stems, terminal shoots and patioles of seedlings, and on pods and flowers of mature plants.</li> <li>- heavy attack can cause death of young seedlings, stunting and delay in flowering of older plants.</li> </ul>	Use resistant varieties. Monitor build-up of aphids and natural enemies. Use neem seeds, soap or hot pepper extracts if necessary.
<b>Pod borer</b> ( <i>Maruca vitrata</i> ) 	<ul style="list-style-type: none"> <li>- most important pod borer pest, causing severe damage to cowpeas.</li> <li>- Moths usually lay eggs on flower buds, flowers, or on terminal shoots of young plants. Young caterpillars may feed on any part of the flowers or foliage. Upon reaching maturity the caterpillars drop from flowers or pods onto the soil and pupate beneath the plant under leaf debris.</li> </ul>	Weekly application of neem seed proved to be more effective. Biological control using <i>Trichogramma spp.</i> parasitoid. Botanical spray of <i>Bacillus thuringiensis</i> . Grow repellent crops such as marigold, basil, onion and citronella. Chemical spray following the manufacturer's recommended rates.
<b>Weevils</b> ( <i>Callosobruchus spp.</i> ) 	<ul style="list-style-type: none"> <li>- Adults are 2.0-3.5 mm long. They are also known as the cowpea seed beetles and are the principal storage pest of cowpea.</li> </ul>	Use neem seeds. Dry seeds for storage to a moisture level of 13%.
<b>Beanfly</b> ( <i>Ophiomyia phaseoli</i> ) 	<ul style="list-style-type: none"> <li>- very destructive during seedling stage of the plant</li> <li>- adult is a minute jet black fly attacking the seedlings just after germination. The maggots feed as miners working down the petiole into the stem (boring holes on the leaves).</li> </ul> <p><u>Severe damage</u> – results to plant wilting and drying-up</p>	Botanical control using neem seeds, soap solution or hot pepper extract. If needed, chemical control for chewing insects.



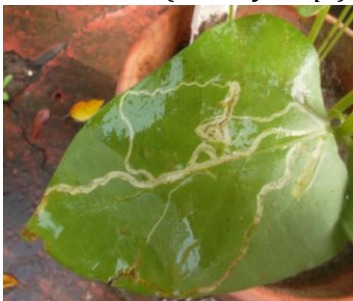



<b>Leafminer (<i>Liriomyza</i> sp.)</b> 	- feeds on the green inner portion of the leaves leaving white zigzag lines.	Conserve natural enemies like spiders, lacewings and syrphid flies. Provide yellow trap with used oil. Intercrop with suitable vegetables like eggplant and okra. Chemical control following the recommended rates.
--	--	---

Table 2. Disease management in bush sitao

Disease	Characteristic/Damage Done	Management
<b>Mosaic virus</b> 	- the disease is caused by a virus commonly carried by aphids or plant lice, the virus may affect every plant in a field and reduce yield, quality, and selling price. The affected leaves usually have irregularly-shaped light green areas of various sizes. Some puckering and other alternation in leaf shape occur.	Keep the aphids under control. Use of resistant varieties is the most economical control measure. Seeds from disease free plants should be used. Rouging and burning of infected plants. Crop rotation in severe cases.
<b><i>Fusarium</i> wilt/ Root rot</b> 	- one of the most destructive of all roots organisms attacking beans, the disease is caused by the fungus ( <i>Fusarium oxysporum</i> ). Root disease prevalent after prolonged rain and water logged condition. Causes an internal rotting and brown discoloration of the vascular tissue inside the stem, followed by wilting, becomes yellow and usually die.	The most successful control of the disease is crop rotation. The use of resistant varieties is also one of the most economical measures. Plant in well-drained soils. Spray effective fungicides to control the disease infection in the field.
<b>Rust</b> 	- disease of the leaves caused by <i>Uromyces phaseoli</i> . The first symptom appears as small white spots or flecks on the underside of the leaves. Within a few days, the spots break open into rust-colored pustules, about pinhead size. A week or so after the pustules appear, the entire leaf begins to turn yellow. Later it turns brown, dries up, and eventually falls off.	Use resistant varieties. Prune infected plant parts.

For effective control, use resistant varieties and other measures like crop rotation, rouging and pruning of infected plant parts and planting of repellant and companion crops, and if needed, the use of chemicals/fungicides will be the last resort in controlling pests and diseases of bush sitao.

## HARVESTING

For use as vegetable, pods are harvested 40-45 days after emergence. Harvesting should be done at 2-3 days interval to prolong the productive life of the plants. Harvesting is done manually. Harvest the pod by holding the stem end before twisting it free. To avoid weight loss, harvesting should be done early in the morning or during the cooler times of the day. The pods should be kept in a shaded area after harvest.

## POST HARVEST HANDLING

Separate the marketable and non-marketable pods. Marketable pods are tender, straight, long and unblemished. Non-marketable pods are short, curved, damaged with insects or diseases and over the picking stage but can still be utilized as vegetable.

### Packing

Pack in plastic sacks, thick lined bamboo baskets, polyethylene bags or wrap the harvested pods with fresh banana leaves. If bush sitao pods cannot be sold or used for 1-3 days, store small quantities in moistened clay jars. Store pods at 12-15°C for not more than 2 weeks at 90% relative humidity if cold storage facilities are available. Keep the pods away from ripening fruits during transport and storage.

## SEED PRODUCTION

Except for isolation and rouging, the cultural management techniques in seed production are similar to fresh pods production.

- A. **Isolation.** The isolation distance depends on the nature of pollination of the crop, whether self or cross pollinated. The isolation distance of bush sitao is 10-50 meters.
- B. **Field Inspection.** It involves identification of a variety and removal of undesirable plants from the main crop through a process termed rouging. The undesirable plants may be weeds, plant of other crop species, plants of another cultivar of the same species, diseased plants and other off-type plants. Rouging should be done at least three times: first at pre-flowering stage; second at flowering; and third at pod formation.
- C. **Harvesting.** Select plants that are vigorous and free from pests and diseases. Harvest pods when physiologically mature or when pods have turned brown. Harvested pods at 20 days after pollination will give the best quality seeds. It may be necessary to harvest 3 times a week at peak harvest. Dry pods should not be allowed to remain in the field to prevent shattering during sunny days rotting or sprouting of seeds within the pods during the rainy days. When dry pods remain longer in the field, these are also being exposed to insect pests.

Place the harvested pods under the sun for 2-4 days until brittle. Threshing is carried on by beating the pods enclosed in net bags or sacks and manually beat with a stick. Separation of seeds from the threshed pods is done by winnowing. Sort out small, wrinkled and seeds damaged by insect. Sun dry the seeds for 4-5 days. Before packaging and storage, seeds must have 10% moisture content (MC). Seeds must be packed in thick plastic, containers or aluminum foil, label with the name of the variety and date of planting then keep in a cool or storage area. In the absence of cold storage, seeds can also be stored in the refrigerator. If properly stored, viability of the seeds becomes longer.



Table 3. Cost and Return Analysis of bush sitao per hectare (seeds)

Items	Quantity	Unit	Rate/Unit	Amount
<b>A. Labor (250/man-day)</b>				
Mowing	4	hrs.	1500.00	750.00
Plowing (2x)	8	hrs.	1500.00	1,500.00
Manure application	4	MD	250.00	1,000.00
Harrowing (2x)	8	hrs.	1500.00	1,500.00
Rotavation	8	hrs	1500.00	1,500.00
Furrowing	2	MAD	500.00	1,000.00
Planting/basal fertilization	8	MD	250.00	2,000.00
Thinning	2	MD	250.00	500.00
Cultivation (Off-baring and hilling-up)	4	MAD	500.00	2,000.00
Irrigation (2MD-12x)	24	MD	250.00	6,000.00
Side-dressing	2	MD	250.00	500.00
Spraying	8	MD	250.00	2,000.00
Weeding (30MD-2x)	60	MD	250.00	15,000.00
Roguing (2x)	4	MD	250.00	1,000.00
Harvesting/hauling	70	MD	250.00	17,500.00
Seed extraction/cleaning/drying	50	MD	250.00	12,500.00
Seed sorting	12	MD	250.00	3,000.00
Seed packaging	2	MD	250.00	500.00
<b>Sub-total</b>				<b>67,750.00</b>
<b>B. Supplies and Materials</b>				
Seeds	12	Kg	300.00	3,600.00
Manure	60	bags	150.00	9,000.00
<b>Fertilizer- Complete</b>	3	Bags	1200.00	3,600.00
Urea	2	Bags	1300.00	2,600.00
Muriate of Potash	2	bags	2000.00	4,000.00
Foliar fertilizer	2	kgs	500.00	1,000.00
Fungicide				1,200.00
Insecticide				10,000.00
<b>Harvesting/Packaging/Drying Materials</b>				
- Sacks	25	Pcs	10.00	250.00
- Sacoline*	30	Meters	50.00	750.00
- Net bag 22 in x 30 in	50	pcs	50.00	2,500.00
<b>Sub-total</b>				<b>37,500.00</b>
<b>C. Power Cost (Electricity)</b>				
				<b>5000.00</b>

<b>Total Cost of Production</b>				<b>110,250.00</b>
<b>Gross Income (300/kg)</b>				<b>210,000.00</b>
<b>Net Income (P)</b>				<b>99,750.00</b>
<b>ROI%</b>				<b>90.5</b>

Seed Yield- 700 kg

\*may be used for two seasons

Table 4. Cost and Return Analysis of Bush sitao per hectare (fresh pods)

<b>Items</b>	<b>Quantity</b>	<b>Unit</b>	<b>Rate/Unit</b>	<b>Amount</b>
<b>A. Labor (300/man-day)</b>				
Mowing	4	hrs.	1500.00	750.00
Plowing (2x)	8	hrs.	1500.00	1,500.00
Manure application	4	MD	250.00	1,000.00
Harrowing (2x)	8	hrs.	1500.00	1,500.00
Rotavation	8	hrs	1500.00	1,500.00
Furrowing	2	MAD	500.00	1,000.00
Planting/basal fertilization	8	MD	2500.00	2,000.00
Thinning	2	MD	250.00	500.00
Cultivation (Off-baring and hilling-up)	4	MAD	500.00	2,000.00
Irrigation (2MD-12x)	24	MD	250.00	6,000.00
Side-dressing	2	MD	250.00	500.00
Spraying	8	MD	250.00	2,000.00
Weeding (30MD-2x)	60	MD	250.00	15,000.00
Harvesting(hauling, upgrading and packing)	70	MD	250.00	17,500.00
<b>Sub-total</b>				<b>P 52,750.00</b>
<b>B. Supplies and Materials</b>				
Seeds	12	Kg	300.00	3,600.00
Manure	60	bags	150.00	9,000.00
<b>Fertilizer- Complete</b>	3	Bags	1200.00	3,600.00
Urea	2	Bags	1300.00	2,600.00
Muriate of Potash	2	bags	2000.00	4,000.00
Foliar fertilizer	2	kgs	500.00	1,000.00
Fungicide				1,200.00
Insecticide				10,000.00
<b>Harvesting/Packaging Materials</b>				
- Sacks	300	Pcs	10.00	3,000.00
<b>Sub-total</b>				<b>37,000.00</b>
<b>C. Power Cost (Electricity)</b>				<b>5000.00</b>
<b>Total Cost of Production</b>				<b>94,750.00</b>
<b>Net Income (P)</b>				<b>39,650.00</b>
<b>ROI%</b>				<b>41.8</b>

Marketable yield = 8,960 kg/cropping

Price is P15.00/kg  
Gross Income – P134,400.00

### **References:**

- BAS. Vegetable Production Data (1991-1995). Bureau of Agricultural Statistics, Quezon, City.
- Carada, V.B. October 1986. Plant Industry Production Guide (26). Cucumber and Vegetables Legumes. Bureau of Plant industry.
- Calingasan, M.K. August 1999. Paper presented to the participants of the Vegetable Seed Production Technology at the Agricultural Training Institute- Farmers Training Center.
- [en.wikipedia.org/wiki/Helicoverpaarmigera](http://en.wikipedia.org/wiki/Helicoverpaarmigera)
- Fliers. Bush Sitao. Department of Agriculture. Bureau of Plant Industry, Los Baños National Crop Research and Development Center.
- Fliers. Production Guide of Pole Sitao. PCARRD. Department of Science and Technology. Information Bulletin No. 154-A/2009.
- <http://www.infonet-biovision.org/default/cct/81/pests>
- <http://www.infonet-biovision.org/default/cct/99/pests>
- <http://www.infonet-biovision.org/default/cct/120/pests>
- How to Farm Better. Published by: Asian Rural Life Development Foundation, International.  
[www.scribd.com/doc/20585310/](http://www.scribd.com/doc/20585310/)





Editorial Team:

Dr. Vivencio R. Mamaril  
Ms. Solita R. Sicat  
Ms. Elenita Sison  
Ms. Ma. Teresa S. Buño

Printed at the Information Section  
Bureau of Plant Industry  
January, 2013