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Vegetable Pigeonpea

A promising crop for India

In many parts of India, vegetable pigeonpea:

- can be grown from improved seed, now available;
- can be more easily cultivated than green pea;
- usually costs less than green pea, and its nutritive value is better; and
- can be cooked into very tasty dishes.

This pamphlet informs readers of the advantages of growing and using vegetable pigeonpea, in the expectation that its popularity will increase in India when its value for domestic consumption is better known.

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Cover: Vegetable pigeonpea seeds.

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Introduction

Pigeonpea (arhar or tur, see Fig. 1), picked while it is still green, is an excellent vegetable. But it is currently an important market commodity as a vegetable (Fig. 2) in only a few areas of India. There is nevertheless considerable potential for the increased consumption of vegetable pigeonpea in the country because new high-quality vegetable cultivars are becoming increasingly available for sowing, and consumers are learning new ways of eating it.

This leaflet lists available cultivars, and describes ways of growing and using the crop for those who would like to cultivate or eat this nutritious vegetable.

Everyone in India has eaten dry pigeonpea seed as arhar or tur dhal because it is an essential part of many diets. Pigeonpea dhal not only has a good taste but its amino acid content almost perfectly complements that of the cereal that is normally eaten with dhal. Yet green vegetable pigeonpea can be even more nutritious than dhal (Fig. 3). Also, when it is cooked properly, vegetable pigeonpea can be an excellent substitute when green pea (*Pisum sativum*) is unavailable (Fig. 4). Although vegetable pigeonpea is not normally as sweet as green pea, it is preferred by some consumers. In addition, vegetable pigeonpea is usually less expensive and contains more protein, solids, and minerals than green pea.

In India, most of the cultivars that are marketed green are small-seeded. By contrast, vegetable pigeonpeas consumed in eastern Africa and the Caribbean are large-seeded and sweet. These cultivars are known to be popular, and researchers at ICRISAT accordingly started a breeding program some years ago to develop sweet large-seeded cultivars that also give stable production.



Figure 1. A vegetable pigeonpea plant (*Cajanus cajan*) with many pods ready for picking



Figure 2 Buying vegetable pigeonpea in a market in Gujarat.

Figure 3 Pigeonpea seeds: on the left, green vegetable seed; center, whole dry seed; right, dhal.

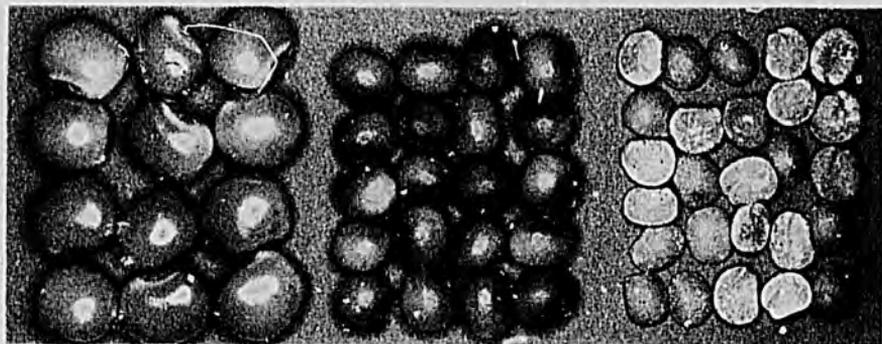


Figure 4 Vegetable pigeonpeas (left): an excellent substitute for more expensive green peas (right).

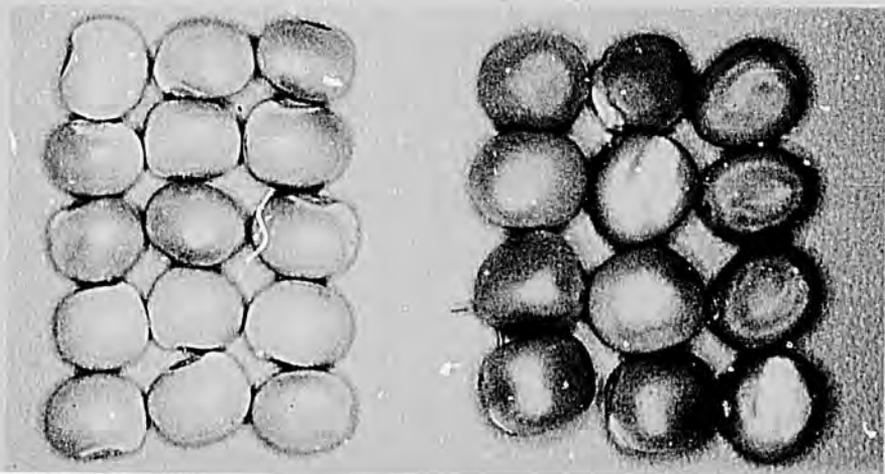


Table 1. Comparison of some nutritional constituents of green and mature pigeonpea seed on a dry-weight basis¹.

Constituent	Green seed	Mature seed	Dhal ²
Protein (%)	21.0	18.8	24.6
Protein digestibility (%)	66.8	58.5	60.5
Trypsin inhibitor (units/mg)	2.8	9.9	13.5
Starch content (%)	48.4	53.0	57.6
Starch digestibility (%)	53.0	36.2	-
Amylase inhibitor (units/mg)	17.3	26.9	-
Soluble sugars (%)	5.1	3.1	5.2
Flatulence factors (g/100 g sol sugar)	10.3	53.5	-
Crude fiber (%)	8.2	6.6	1.2
Fat (%)	2.3	1.9	1.6
Minerals and trace elements (mg/100 g)			
Calcium	94.6	120.3	16.3
Magnesium	113.7	122.0	78.9
Copper	1.4	1.3	1.3
Iron	4.6	3.9	2.9
Zinc	2.5	2.3	3.0

1. Source: Various reports and publications available from ICRISAT, Patancheru, A.P. 502 324, India.

2. Split seed with seed coat removed.

Nutrition

When used as a vegetable, pigeonpea is normally picked when the seeds have reached physiological maturity, that is, when they are fully grown but just before they lose their green color. At this stage the green seed is more nutritious than the dry seed because it has more protein, sugar, and fat than the mature seed (Table 1). In addition, its protein is easily digestible. Although there is less starch in the green seed it is more digestible than the mature seed. Also, in the green seed there are considerably lower quantities of the sugars that produce gas in the intestine (flatulence). However, there are fewer minerals in the green seed than in the mature seed.

Table 2. Comparison of some nutritional constituents of the edible portion of green pea and vegetable pigeonpea on a fresh-weight basis¹.

Constituent	Green pea	Vegetable pigeonpea
Chemical composition (g/100 g)		
Edible portion (shelling %)	53.0	72.0
Moisture	72.1	65.1
Protein	7.2	9.8
Carbohydrates	15.9	16.9
Crude fiber	4.0	6.2
Fat	0.1	1.0
Mineral and trace elements (mg/100 g)		
Calcium	20.0	57.0
Magnesium	34.0	58.0
Copper	0.2	0.4
Iron	1.5	1.1
Vitamins (mg/100 g)		
Carotene (vit. A /100 g)	83.0	469.0
Thiamin (vit. B1)	0.1	0.3
Riboflavin (vit. B2)	0.01	0.3
Niacin	0.8	3.0
Ascorbic acid (vit. C)	9.0	25.0

1. Source: Gopalan, C., Rama Sastri, B.V., and Balasubramanian, S.C. 1984. Nutritive value of Indian foods. Hyderabad, India: Indian Institute of Nutrition. 204 pp.

Nutritionally, green pigeonpea and dhal are similar but, on a dry-weight basis, vegetable pigeonpea has less protein and starch than dhal, but it has more fiber, fat, and minerals (Table 1).

In comparison with green pea, vegetable pigeonpea takes longer to cook and is not as sweet, but is much more nutritious. On a fresh-weight basis, vegetable pigeonpea has a greater edible portion, more protein, carbohydrates, crude fibers, and fat than green pea (Table 2). Vegetable pigeonpea also has more minerals and generally much more of some vitamins than green pea. Particularly noteworthy is their very high level of Vitamin A and their high level of Vitamin C. Vegetable pigeonpea therefore makes an excellent and cheaper substitute for green pea in areas where green pea cannot be grown, or when it is out of season.

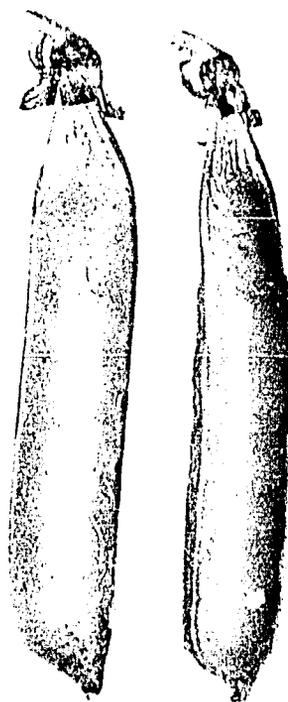


Figure 5. Vegetable pigeonpea pods on the plant, with size comparisons: a pen (left) and green pea pods (inset).

Choice of Cultivars

The best vegetable pigeonpea cultivars have long pods (Fig. 5) with as many as nine large sweet seeds (weighing about 15 g 100 when dry), which are easily removed from the shell. Pigeonpea seen in most

Indian markets for use as a vegetable, however, are from small-podded and small-seeded (7-10 g/100 dry seeds) cultivars that are normally grown for dry-seed harvesting and marketing as dhal. In Gujarat there are cultivars that produce dry seeds weighing about 10-12 g/100. These cultivars are grown as a normal field crop, but the pods are harvested at the appropriate stage of maturity for use as vegetable pigeonpea.

Harvesting of pigeonpeas for sale as a vegetable is more common near cities where the green pods can be readily marketed. In some cases part of the crop is left for harvesting later as dry seeds.

In India consumers prefer vegetable pigeonpea with green pods. These usually command a higher price than striped ones, or pods of other colors. Tests at ICRISAT Center with immature pods have shown, however, that differences in pod color are not related to cooking time, taste, or nutritive quality. Cultivars with white seed coats when mature, which gives them a bright green color when harvested as a vegetable, are usually preferred to ones that are colored because the cooking water remains clear.

Sweetness of the seed is also a preferred character. Normal sugar levels are around 5.0%; but researchers at ICRISAT Center have identified varieties, such as ICP 7035, with a sugar content as high as 8.8%.

In Gujarat the cultivar T 15-15 is widely grown as a vegetable pigeonpea. There are also many white-seeded local cultivars. Recently, the wilt-resistant small- and white-seeded line BDN 2 has been introduced to combat the increased incidence of wilt disease occurring under the intensive production system being used in parts of Gujarat. In southern India the large-seeded lines Hy 3C and TTB 6 are grown, and there are other locations in India, particularly in some hilly tribal areas, where other large-seeded cultivars are grown. An example is ICP 7035, which has large and sweet seeds and good disease resistance.

Several of the very large white-seeded cultivars grown in eastern Africa and the Caribbean have been tested at ICRISAT Center, but most were found to be unsuited to the Indian semi-arid tropics. However, scientists at ICRISAT have identified or bred some large-seeded lines, including ICPL 24, ICPL 211, and ICPL 87, that appear to have good yield potential.

In selection, earliness in maturity is a character considered appropriate for vegetable pigeonpea, although some medium-maturing lines have performed well, and some late-maturing large-seeded genotypes can be grown for a few years as a hedge around or in gardens. There are also some early-maturing cultivars that continue to produce pods for a long time and can therefore produce more than one crop in a year, of which ICPL 87 is an example.



Figure 6 Harvesting mature seed from short-statured determinate vegetable pigeonpea plants

Cultivation and Harvesting

The cultivation requirements for vegetable pigeonpea are the same as those for other cultivars, where farmers grow pigeonpea of normal seed size (up to about 12 g/100 seeds). But there are some modifications in cultivation that can improve the production of vegetable pigeonpea. In Gujarat, for example, the rows are usually spaced 90-150 cm apart to permit ease of cultivation, spraying, and pod-picking—it being important that pod-picking should be done frequently so that seeds may be marketed at just the right stage of maturity.

For the successful cultivation of the few large-seeded cultivars currently available for producing vegetable pigeonpea, more careful agronomy is necessary than that required for other cultivars. The amount of special attention needed, however, varies with each cultivar. For example, some large-seeded cultivars produce pods in bunches at the top of the plants. This means that these cultivars are more susceptible to insect attack than others, but, because they are short-statured, they are easier to spray with insecticides and are more convenient to harvest (Fig. 6). However, such varieties require a higher seeding rate than the indeterminate varieties. The large pods of the vegetable varieties are very attractive to insects which means that a careful regime of insecticide application may be necessary. In planning each regime the required number of days for each type of insecticide must be allowed between the last spraying and the beginning of harvesting.

It is possible to continue harvesting green pods for an extended period because pigeonpea is a perennial. Such a harvesting period may be increased if ratoonable cultivars are grown in areas where there are long rainy seasons, or where irrigation is available. Under such conditions this type of crop will usually continue producing pods as long as it remains free of diseases and the mean temperature remains between about 15 and 30°C. A yield of 11 t/ha of green pods, harvested in five pickings, has been recorded by Dr S.A. Patel at Anand, Gujarat, on a small plot of ICPL 24. It is also possible to grow pigeonpea as trees for 4 or 5 years (Fig. 7) in a garden where there is irrigation, or where there is sufficient rainfall, and where each flush of green pods is harvested as it reaches the right stage of maturity.

To ensure that the pods are harvested just before they start to lose their bright green color, it is desirable that the seeds should be sampled, making allowance for the fact that the appearance of pods at this stage varies with each cultivar. In the Caribbean, harvesting has been mechanized by the successful adaptation of mechanical green bean pickers for use with vegetable pigeonpea.



Figure 7 A 2-year old pigeonpea tree (photographed in Antigua)

Utilization

The pods can be shelled by hand in the same way that green pea pods are shelled. At many canneries in the Caribbean special podders are used for shelling vegetable pigeonpea mechanically. A small-scale hand-operated green pea sheller is being built at ICRISAT Center for trial with vegetable pigeonpea.

In cooking, when vegetable pigeonpea is substituted for green pea, a slightly longer cooking time is usually required. Some delicious recipes, especially developed for pigeonpea, are available, and four examples from the Food Services Division at ICRISAT Center are given in the Appendix of Recipes. Others have been previously published in the International Pigeonpea Newsletter: see p.68 of no. 4 (March 1985) and pp.49 and 80 of no. 5 (May 1986).

Appendix of Recipes

Green pigeonpea massalam (vegetarian): serves four

Ingredients	Quantity
Green pigeonpea seed	250 g
Tomatoes (ripe)	200 g
Onions	50 g
Ginger	20 g
Garlic	20 g
Yoghurt (curd)	100 g
Fresh coconut (copra)	20 g
Cumin seeds	5 g
Cinnamon/cardamom	3 g
Oil	100 g
Lime (optional)	One
Turmeric	A pinch
Garam massala	A pinch
Coriander leaves	A bunch
Salt	To taste

Method

1. Wash the pigeonpea seed, boil for 5 min with a pinch of sodium bicarbonate, drain, and keep aside.
2. Blanch the tomatoes, remove their skins and seeds, and chop them finely.
3. Fry the sliced onions to a golden color, grind to a paste with curd, ginger, and garlic, and keep separately.
4. Grind the coconut after taking out the milk. Save the milk.
5. Over a low heat, fry the onion paste, copra paste, cumin seeds, and turmeric powder. After 5 min add the blanched tomatoes. Keep frying over a low heat until the raw smell ceases.
6. Add the coconut milk, boiled pigeonpea, and salt; cook for another 10 min until the gravy thickens. Remove from the heat and mix in juice from the lime (optional). Sprinkle in the garam massala and garnish with chopped coriander leaves.
7. Serve hot with chappati, paratha, puris, bhatura, or rice.



Figure 8. Cooked dishes: puris stuffed with pigeonpea (top), green pigeonpea massalam (left), with prawns (center), and with paneer (right).

**Prawns with pigeonpeas
(non-vegetarian):** serves four

Ingredients	Quantity
Green pigeonpea seed	250 g
Prawns (shelled)	250 g
Yoghurt (curd)	150 g
Onion	100 g
Oil	100 g
Ginger	20 g
Garlic	20 g
Fresh coconut (copra)	30 g
Poppy seeds	30 g
Cinnamon	3 g
Cardamoms	3 g
Bay leaf	2 leaves
Garam massala	A pinch
Coriander leaves	A sprig
Salt	To taste

Method

1. Clean, soak, and boil the pigeonpea seed for 5 min with a little sodium bicarbonate, drain, and keep aside.
2. Slice the onions and fry them to a golden brown.
3. Remove the milk from the coconut and keep separately.
4. Grind the onion, curd, ginger, garlic copra, and poppy seeds together.
5. Clean the prawns by removing the vein.
6. Soak the prawns for 1 hour in the ground paste from 4 above.
7. Heat the oil with the cinnamon and cardamoms over a very low heat; fry for 2 min. Add the prawns to the garam massala and keep frying. If the mixture becomes dry, keep adding small quantities of coconut milk.

8. Cook for 20 min, then add the boiled pigeonpea seed, the remaining coconut milk, and salt; simmer for another 10 min and serve, garnished with sliced tomatoes and chopped coriander leaves.

**Green pigeonpea with paneer
(vegetarian):** serves four

Ingredients	Quantity
Green pigeonpea seed	450 g
Cottage cheese (paneer)	150 g
Coriander powder	5 g
Chilli powder (or paprika)	¼ teaspoon
Onions	50 g
Fat	30 g
Garlic	3 flakes
Ginger	A small piece
Tomatoes	220 g
Cashew nuts	30 g
Yoghurt (curd)	30 g
Salt	To taste
Green coriander leaves	A few sprigs
Garam massala	2 pinches
Turmeric	A pinch

Method

1. Grind together the onions, coriander powder, chilli powder, turmeric, ginger, and garlic to a fine paste to make a ground massala.
2. Grind the cashew nuts separately.
3. Boil the green pigeonpea seed with a little salt and sodium bicarbonate for nearly 5 min, strain, and cool. Retain the water in which the green pigeonpea seed was boiled to use later to make the gravy.
4. Blanch the tomatoes in hot water, remove their skins and seeds, and keep aside after chopping.

5. Cut the paneer into small cubes. Heat the fat, fry the paneer pieces lightly, and remove. In the same fat, add the ground massala and chopped blanched tomatoes. Fry for about 3 min, add the pigeonpea seed and a little water, and continue cooking until the pigeonpea is soft and the ground massala is cooked.
6. Add the fried paneer and a little water. Simmer for about 4 min.
7. Add ground cashew nuts and beaten curd, mix well, and continue to simmer. When the mixture thickens, remove it from the heat and sprinkle in the garam massala.
8. Serve hot, garnished with chopped coriander leaves.

Puris stuffed with green pigeonpea (vegetarian): serves four

Ingredients	Quantity
Green pigeonpea seed	200 g
Lentil dhal	50 g
Onion (minced)	50 g
Green chillies	Two
Cumin powder	¼ teaspoon
Salt	To taste
Garam massala	2 pinches
Water	220 ml
Turmeric	A pinch
Asafoetida (hing)	A pinch

Covering

Maida (flour)	450 g
Fat	30 g
Salt	1 teaspoon
Water to mix	250 ml
Oil (for deep frying)	250 g

Method

1. Shell the green pigeonpea; clean and wash the lentil dhal.
2. Boil the lentil, squeeze out all water, and mash.
3. Boil the green pigeonpea, squeeze out all moisture, mash and mix with the mashed lentil.
4. Crush the green chillies.
5. Put in all ingredients for the filling except the salt, and cook over a low heat until all the water has evaporated. Add salt, garam masala, and, after mixing well, remove from the heat.
6. For the covering, sieve the flour with salt and add melted fat and water. Make into a fairly stiff dough.
7. Allow the dough to stand for 1 hour.
8. Divide the dough into about 16 even-size balls, roll them very thinly into even, round shapes, spread the pigeonpea filling evenly on eight of them, cover the filling with the remaining eight, and then pinch the edges (with a little water) to enclose the filling. A round biscuit cutter can be used to cut the stuffed puris into even round shapes.
9. Deep-fry in hot oil until the puris become a light golden brown.
10. Serve hot with a little tomato sauce or dry vegetable curry.