

Research Note

MUNGBEANS: A VERSATILE CROP WITH POTENTIAL UNDER CONDITIONS IN PUERTO RICO¹

The mungbean (*Vigna radiata* (L.) Wilczek Bart and Ganpat)² is a legume crop of great potential for the tropics because it produces sizeable yields of high-protein food without N fertilization and provides N to succeeding crops. Mungbeans are a preferred food in Asia² and are also consumed by East Indian and Chinese populations in English-speaking countries of the Caribbean. One advantage of mungbean over other edible legumes is its higher digestibility and decreased tendency to cause flatulence. Mungbean sprouts are in worldwide demand for use in Chinese cuisine. In 1974, the United States alone consumed about 25 million pounds of mungbeans mostly as sprouts². Because of the increasing boom in Chinese restaurants throughout Puerto Rico, there is a sizeable market here. Furthermore, the continental United States provides a potential export market. By-products of mungbean production have been used for animal feed and the crop may be grown for hay, green manure and as a cover crop. The drought-resistant³ characteristic and the short maturity of the mungbeans make them a versatile crop in multiple cropping programs.

The mungbean has been cultivated for food since ancient times in India. Its wild ancestors are probably *Vigna* (*Phaseolus*) *radiata* var. *sublobata* (Roxb.) Verdc. and/or *Vigna* (*Phaseolus*) *trinervius* (Wight and Arn) Verdc. both of which occur wild in India⁴.

The mungbean was introduced long ago into Pakistan, Southern China, Vietnam and Java. It is also a widely grown food legume in East and Central Africa and Peru⁵. In comparatively recent years it has been introduced to the West Indies and to the United States.³

The crop grows well on good loamy soils under 750 to 900 mm of well-distributed rainfall. It is drought-resistant but susceptible to waterlogging.

¹ Manuscript submitted to Editorial Board October 24, 1979.

² Bart, A., and Ganpat, R., 1975, Mung-beans: Potential for cultivation in Trinidad and Tobago. Paper presented at the XIII Annual Meeting, Carib. Food Crops Society, St. Augustine, Trinidad.

³ Rachie, K.O., and Roberts, L.M., 1974, Grain legumes of the lowland tropics, *Advances in Agronomy*, Acad. Press, (N.C. Brady, Ed.), pp. 2-132.

⁴ Verdecourt, B., 1970. Studies in the *Leguminosae-Papilionoideae* for the "Flora of Tropical East Africa: III Kew. Bull. 24 (Lectotype of subgenus: *Vigna radiata* (L.) Wilczek (= *Phaseolus radiatus* L.), 556-9.

⁵ Poehlman, J.M. and Fu-Meitu-Jean, F., 1972. Bibliography of mungbean research, Univ. Missouri Agri. Exp. Stn. Sp. Rep. 184.

Choudhury et al.⁶ claim that this water-logging susceptibility can be alleviated by ridge planting.

Mungbeans are a rather versatile crop. According to reports from India, it can be intercropped with corn³. In Taiwan, it has been reported to be "the most profitable crop" to intercrop with sugarcane. Chapman and Garioch⁷ report its utilization as a cover crop in sugarcane fields in Australia. Tomlinson and Plaxico⁸ used mungbeans successfully in a double cropping scheme following wheat in the sandy soils of central Oklahoma. In Zaire, it is used in rotations with corn and root crops⁹. In some areas of Trinidad, mungbeans have followed after rice harvesting³ since around 1950.

Mungbeans are widely used as bean sprouts. For this purpose, seeds are soaked overnight, drained, placed in containers stored in dark places and sprinkled every few hours. Sprouts are ready to be harvested within a week. Rachie and Roberts³ figure that 1 kg of dry seeds can yield some 6 to 8 kg of bean sprouts. This is a substantial yield that easily multiplies the value of the crop. The green pods and seeds can be consumed as green vegetables.

The dried beans can be boiled and eaten whole or split into a soup or porridge. Beans can also be parched and ground into flour after removal of the testa. According to Singh et al.¹⁰ removal of the testa does not affect the nutritive value of the bean because the cotyledons contain a well-balanced supply of minerals and protein. The flour has many uses in deep-fried and spiced noodles, balls and snacks. It can be baked into bread and biscuits.

Data from Pursglove¹¹ reveal that dry seeds of *Vigna radiata* var. *aureus* have the following composition:

<i>Item</i>	<i>Percent</i>
Water	9.7
Protein	23.6
Fat	1.2
Carbohydrates	58.2
Fiber	3.3
Ash	4.0

⁶ Choudhury, S.L. and Bathia, P.C., 1971. Ridge planted kharif pulses yield high despite water-logging, *Indian Farming* 21 (3):18-19.

⁷ Chapman, L.S. and Garioch, D., 1966. Legume varieties for the Central District, Cane Grow, Bull. 30 (2):57-9, Queensland, Australia.

⁸ Tomlinson, J. and Plaxico, J.S., 1962. An economic analysis of mungbean as a crop for sandy soils of central Oklahoma, *Oklahoma Agri. Exp. Stn. Bull.* 3-595.

⁹ Hecq, J. and Lefebvre, A., 1961. Rotation in Kivu (Congo), *Agri. Congo Bull.* 52 (1):1-8.

¹⁰ Singh, S., Singh, H.I. and Sikka, K.C., 1968. Distribution of nutrients in the anatomical parts of common Indian pulses, *Anal. Chem.* 45 (1):13-18.

¹¹ Pursglove, J.W., 1968. *Tropical Crops: Dicotyledons I.* Longmans, Green, New York.

Experiments, following a randomized block design with six replications, were conducted at two sites: 1) At Manatí, on a Bayamón soil (Typic Haplorthox, sandy loam in the surface and clayey underneath, oxidic, isohyperthermic)¹². The topography is undulating; elevation, 50 to 130 m, with full exposure to the sun. Soil pH at the surface layer was slightly over 5.0, but decreases to 4.8 at 25 to 50 cm depths. Organic matter was 1.6%; CEC, 2.5 meq; Ca saturation, 52%. Al was only 0.3 meq. Available water stored in the upper 30 cm of this soil was 3.6 cm^{13,14}. The bulk of the soil-water was released at tensions between field capacity and 1 bar. 2) At Corozal, on a Humatas soil (Typic Tropohumults, clayey, kaolinitic, isohyperthermic¹²). The soil occurs in hilly areas with northern exposures at elevations of 220 to 580 m. Soil pH was 5.0 at the surface, 4.6 at the 25 to 50 cm depth; organic matter, 3.7%; CEC, 7.9 meq; Ca saturation, over 80%; Al, negligible on the surface but increased to almost 70% saturation on the 25 to 50 cm depth. Available water stored in the upper 30 cm was 5.0 cm. A high proportion of the soil-water was available only at tensions above 1 bar^{13,14}.

Seeds of an unidentified cultivar were introduced from Trinidad. They were planted on 4.57 × 9.15 m plots April 1 and May 17 at Manatí and Corozal, respectively. Seeds were set at 61 cm between rows and 23 cm within the row. The plots were weeded manually. Excellent crop protection was attained through biweekly applications of Sevin¹⁵ and Dithane at rates of 1.40 and 1.68 kg/ha, respectively. The crop received fertilizer at planting as follows: 112 kg/ha of P₂O₅ as triple superphosphate, 112 kg/ha of K₂O as sulphate and 56 kg/ha of Mg as sulphate. No N was applied.

At Manatí, mungbeans were harvested as dry pods at 90 days from planting. At Corozal, they were harvested as green pods when 60 days old. Two border rows were left unharvested at the time to estimate dry grain yields. The inner rows were planted again without any additional fertilizer. Stover yields were recorded at both locations.

Table 1 shows grain and stover yields at both sites. They compare favorably with those obtained at other locations outside Puerto Rico³.

¹² Lugo-López, M.A. and Rivera, L.H., 1977. Updated taxonomic classification of the soils of Puerto Rico, Univ. P.R. Agri. Exp. Stn. Bull. 268.

¹³ Wolf, J.M. and Drosdoff, M., 1976. Soil-water studies in Oxisols and Ultisols of Puerto Rico: I. Water movement, J. Agri. Univ. P.R. 60 (3):375-85.

¹⁴ Wolf, J.M. and Drosdoff, M., 1976. Soil-water studies in Oxisols and Ultisols of Puerto Rico: II. Moisture retention and availability, J. Agri. Univ. P.R. 60 (3):386-94.

¹⁵ Trade names in this publication are used only to provide specific information. Mention of a trade name does not constitute a warranty of equipment or materials by the Agricultural Experiment Station of the University of Puerto Rico, nor is this mention a statement of preference over other equipment or materials.

Grain yields are particularly good on the Corozal Ultisol in relation to the short life span of the crop. Yields of this magnitude, nearly 4850 kg/ha of grain for a short period of less than 120 days, are substantial. They are impressive in view of the fact that no fertilizer N was required.

Under the conditions prevailing in Trinidad³, at 25 cm within the row and an interrow spacing of 22.5 cm, mungbeans yielded 2180 kg/ha while at 30 cm interrow spacing yields were 1090 kg/ha. At a 37 cm interrow spacing, yields ranged from 654 to 700 kg/ha. The Puerto Rico plantings—at 21 cm within the row and an interrow spacing of 61 cm—were possibly too thin. If plant population density had been at the same levels as in the close planting Trinidad trials, probably much heavier grain yields could have been expected. Furthermore, weed growth could have been reduced with closer spacing. At 22.5 cm interrow spacing, weed growth was negligible under Trinidad conditions. Bart and Ganpat² reported response to N fertilizers. The response was marked at the highest levels of P. The response to K was only moderate.

In addition to a source of high-protein food that can be consumed in

TABLE 1.—*Yields of mungbeans at two locations in Puerto Rico*

Soil and site	Crop	Grain	Stover
		<i>kg/ha</i>	
Oxisol at Manatí	1	1125 ¹	2170
Ultisol at Corozal	1	2044 ¹	2576
	2	2800 ²	

¹ Dry beans.

² Green pods with tender grains.

multiple ways, mungbeans can be very valuable as source of N for succeeding crops in a rotation or crop sequence. They are a quick maturing crop, suitable for green manure, that can be plowed under at about 35 to 45 days of age. Pérez-Escolar et al.¹⁶ reported that corn yields increased from 2336 kg/ha, in rotation experiments where corn followed corn, to 3096 where corn followed mungbeans. The legume stover had been plowed under after harvesting the grain. Data are as follows:

<i>Treatment</i>	<i>Corn yields, kg/ha</i>
<i>At Manatí</i>	
Corn, corn	4716
Mungbeans, corn	5384
<i>At Corozal</i>	
Corn, corn	2336
Mungbeans, corn	3096

¹⁶ Pérez-Escolar, R., Scott, T. W., and Lugo-López, M. A., 1978. Legume and non-legume crop residues as sources of N in Oxisols and Ultisols, *J. Agri. Univ. P.R.* 62 (4):361-66.

At Manatí, the incorporated legume stover N (Kjeldahl) was 33 kg/ha; at Corozal, 24. There was no apparent statistical relationship between the amount of N returned to the soil from these residues and mean yields of the subsequent corn crop. When the grain of a legume like mungbeans is harvested, much of the N is removed. There must have been a sizeable amount of N in the roots that remained in the soil. On the highly leached, weathered, well-drained, highly acid, low fertility soils of the humid tropics, mungbeans can be a very useful crop providing food for human and animal consumption as well as nutrients—mainly N—for succeeding crops on rotation. They are evidently adapted to a wide range of soil conditions.

Bart and Ganpat³ report that mungbeans, because of early fast growth and very short life cycle (63 days from seeding to harvest), fit well in intercropping schemes with sugarcane, plantains, bananas, yams, hot pepper and ginger. The same short life cycle was observed under conditions in Puerto Rico when harvested as green pods. Thus, the same potential for intercropping can be realized. Furthermore, several crops of mungbeans/year can be obtained. By adjusting land preparation operations, mungbeans can be used as a quick filler crop succeeding a rice crop and prior to vegetables in the dry season under conditions in Trinidad³. Furthermore, mungbeans are better than blackeye and red-kidney beans during the wet season because mungbeans are not affected by plant and pod disease problems that are common in beans.

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