A Research Note

Nutritional Quality of Vegetable Pigeonpeas [Cajanus cajan (L.) Mill sp.]: Mineral and Trace Elements

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ABSTRACT

Mineral and trace elements of green and mature seed of pigeonpea genotypes were determined. Among the genotypes tested a considerable variation was observed in phosphorus, potassium and calcium of both green and mature seeds whereas the variation was small for magnesium. When consumed, green seeds are a richer source of iron, copper and zinc on a dry matter basis than the mature seed whereas there was a reverse trend for manganese. The calcium content of mature seed was significantly higher than green seed and this was attributed to the seed coat content of the mature seed.

INTRODUCTION

THE PROTEIN SUPPLEMENTATION VALUE of grain legumes in cereal-based diets is well recognized. Grain legumes are also a rich source of vitamins, especially the B-complex, and of minerals such as calcium and iron (Meiners et al., 1976; Gopalan et al., 1978). Some of the minerals, particularly phosphorus, calcium and magnesium, have been reported to play an important role in influencing the cooking quality of pigeonpea (Sharma et al., 1977). Except for calcium the differences in the mineral composition between whole grain and cotyledons of four Indian food legumes have been reported to be marginal (Sankara Rao and Deosthale, 1981). Kadwe et al. (1974) reported large varietal differences in the mineral composition within several pulse crops.

The green seeds of pigeonpea are used as a vegetable in India and generally large seeded cultivars are preferred for this purpose. Earlier reports have indicated considerable differences between green and mature pigeonpea seed in the nutritional quality of carbohydrates and proteins (Singh et al., 1983). The objective of this study was to compare the mineral and trace element composition of green and mature seeds of some pigeonpea genotypes with a range in seed size.

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MATERIALS & METHODS

NINE PIGEONPEA GENOTYPES (Table 1) with a range in seed size, grown in unreplicated plots, were used for the present investigation. These were grown on black soil during the 1980-81 rainy season at ICRISAT Center, near Hyderabad, India, under normal cultural practices with no irrigation or fertilizer applied. Mature and green seeds were harvested, ground and defatted as described earlier (Singh et al. 1983).

Samples for the determination of mineral contents were prepared in a block digestor by using a nitric acid-sulphuric acid-perchloric acid mixture (Piper, 1966). These samples were analyzed for potassium, calcium, magnesium, zinc, copper, iron and manganese by using an atomic absorption spectrophotometer (Varian Techtron, Model-1200). Phosphorus in the digested aliquots was estimated according to the standard colorimetric procedure (Koenig and Johnson, 1942). All values are expressed on a moisture free basis. Mean coefficient of variability ranged between 0.49 and 2.83 percent for all the mineral and trace elements reported in this paper.

RESULTS & DISCUSSION

LARGE DIFFERENCES were observed among the calcium and phosphorus contents of the green seeds of the genotypes tested (Table 1). A similar variation was observed when mature seeds of the same genotypes were analyzed (Table 1). Potassium content showed a similar variation, although of a lower magnitude, in both the mature and green seeds. Calcium concentration (mg/100g) of green seed ranged between 59.8 and 137.1 with a mean of 94.6, and between 78.8 and 170.0 with mean of 120.8 for mature seed. Among the genotypes tested, ICPL-128 had the lowest calcium content. Calcium content of the mature seed was significantly higher than the green seed (Table 2); this could be due to a larger amount of seed coat in mature seed (Singh et al., 1983). Seed coat has been reported to contribute a large proportion (about 70%) of the calcium to seed of pigeonpea (Sankara Rao and Deosthale, 1981)

Table 1—Mineral and trace element composition (mg/100g) of green and mature seed of various pigeonpea cultivars

Culvitar/ line	Phosphorus		Potassium		Calcium		Magnesium		Zinc		Copper		Iron		Manganese	
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
ICPL-102	283	282	1045	1269	95.9	103.4	95.9	105.6	2.62	2.41	1.46	1.10	4.23	3.60	1.07	1.06
ICPL-114	273	284	1277	1198	137.1	170.0	126.1	136.7	2.32	2.19	1.41	1.39	4.32	3.71	1.29	1.70
ICPL-119	317	311	1377	1212	103.4	113.5	118.2	121.2	2.35	2.19	1.50	1.28	4.49	4.10	1.34	1.36
ICPL-122	321	324	1433	1335	77.6	120.5	110.8	121.0	2.58	2.40	1.50	1.51	4.70	4.38	1.07	1.39
ICPL-128	277	290	1527	1508	59.8	78.8	125.1	100.5	2.43	2.11	1.43	1.14	4.39	4.34	0.84	1.22
ICPL-212	273	273	1373	1228	128.0	149.8	122.7	141.7	2.28	2.36	1.50	1.24	4.49	3.53	1.34	1.76
ICP-6997	257	283	1528	1223	89.2	122.7	112.8	120.9	2.59	2.27	1.47	1.24	4.37	3.23	1.03	1.48
ICP-7035	264	362	1498	1469	92.3	114.1	108.3	141.6	3.07	2.40	1.39	1.56	5.16	3.48	0.99	0.99
C-11	272	206	1537	1279	68.3	114.3	103.5	108.5	2.28	2.07	1.22	1.15	5.07	4.50	0.91	1.11
Mean	282	290	1399	1302	94.6	120.8	113.7	122.0	2.59	2.27	1.59	1.29	4.59	3.88	1.10	1.34
SE ±[c]	3.45	4.60	12.74	11.36	1.98	2.28	0.86	0.74	0.01	0.01	0.08	0.13	0.06	0.07	0.02	0.02

[a] Green seed
[b] Mature seed
[c] Standard error of estimation

Table 2—Range and mean values of mineral and trace elements (mg/100g) in green and mature seeds of pigeonpea

Constituent	Maturity stage	Range	Mean	SD[a]
Phosphorus	Green	257–321	281.9	14.15
	Mature	206–362	290.6	
Potassium	Green	1045–1537	1399.4	51.39
	Mature	1198–1508	1302.3	
Calcium	Green	59.8–137.1	94.6	4.52
	Mature	78.8–170.0	120.8	
Magnesium	Green	95.9–126.1	113.7	5.13
	Mature	100.5–141.7	122.0	
Zinc	Green	2.28–3.07	2.50	0.07**
	Mature	2.07–2.41	2.27	
Copper	Green	1.22–1.50	1.43	0.06*
	Mature	1.10–1.56	1.29	
Iron	Green	4.23–5.16	4.58	0.16**
	Mature	3.23–4.50	3.87	
Manganese	Green	0.84–1.34	1.10	0.06**
	Mature	0.99–1.76	1.34	

[a] Standard deviation of the difference
* Significant at 5% level
** Significant at 1% level

and chickpea (Jambunathan and Singh, 1981), therefore, the observed variation in the calcium content may be due to the variation in their seed coat content of these samples as the whole seed samples were analyzed.

While no large variation in the iron content among these types was observed, the mean iron concentration of the green seed was significantly higher than in the mature seed. Also green seed appeared to be a richer source of copper and zinc (Table 2). No significant differences in the composition of phosphorus, potassium and magnesium were observed when the values for green and mature seeds of these genotypes were compared.

Calcium and iron are important nutrients but are usually deficient in the diets of low income people particularly infants, pre-school children, and pregnant and lactating women. For these people green pigeonpea seed eaten as a vegetable can be a source of iron. Since mature seed of pigeonpea is normally eaten after removal of its testa, which provides about 70% of the total seed calcium, green seed, which is normally eaten with its testa, could provide a very good source of calcium. However, it is still reasonable to study the bioavailability of calcium and iron from the green and mature seed before a final conclusion is drawn.

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cant. However, the average quoted values for these and other components should provide useful and meaningful information for many in health and related professions.

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