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## **Pigeonpea as a Niche Crop for Small Farmers**

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### **Abstract**

Pigeonpea is a nutritious legume crop that has the ability to fix nitrogen, grow on marginal lands and has multipurpose use for human consumption, animal feed and fuel. India is the largest producer and consumer of the crop. However, there is growing interest to produce the crop by other countries including the United States. The focus of this study was to examine the role of row spacing on yield. Using Analysis of Variance (ANOVA) it was found that spacing affects yield. That is, the more the spacing the more the yield.

**Keywords:** Pigeonpea, Niche crop, Small Farmers, Tennessee, Analysis of Variance.

## Introduction

Small Farms, which make up approximately 91% of all farms in the United States, are diverse (Hoppe, 2010; USDA, 2007). They control a significant share of farm assets and are important for the vitality of rural communities (USDA, 1998; Steele, 1997). They also participate in government programs such as the Conservation Reserve Program (CRP) and the Wetlands Reserve Program (WRP). Despite their number and importance, small farmers continue to face a number of challenges arising from domestic policy changes, globalization, concentrated and vertically integrated large farm operations that dominate national and international markets (Ebodaghe, 2009; Tegegne et al., 2004).

Small farmers can use different strategies to deal with the above challenges including diversification of their farm operations, introducing on farm value adding activities, as well as strengthening farmers' networks to improve market access using different marketing channels (Mishra et al. 2004; Tubene and Hanson, 2002).

One possible niche crop is Pigeonpea (*Cajanus cajan* L. Millsp), a low input, and warm season grain legume. It is tolerant of dry weather and poor soil conditions (Metz et al., 2007; Phatak et al., (1993). It grows well on marginal lands and being a deep-rooted crop, is drought tolerant and capable of growing in semi-arid conditions with less than 635 mm of rainfall (Baryeh and Mangope, 2002). Its deep tap root and abundance of organic matter is known to improve soil and soil water storage. It has capability to fix nitrogen and is noted for its great soil adaptability than other legumes. Pigeonpea seeds are nutritious, have high-protein (21%) with high protein digestibility (68%), low in fat, sodium, have zero cholesterol, and high dietary fibers (Morton, 1976; Salunkhe et al., 1986; Sinha et al., 1977). The crop ranks sixth in the World in dry land legume production (Arnold, 2002). It provides healthy food for humans; animal feed and fuel (Whiteman et al., 1981). India is the largest producer and consumer of the crop.

Work by Metz et al., 2007; Phatak et al., (1993) have underscored the potential of pigeonpea production in the Southeastern United States. Studies by Rao et al., (2002; 2003) have focused on production and use of the crop for forage. Currently there is work underway at Tennessee State University, Alabama A and M University and Virginia State University with funding support from the United States Department of Agriculture (USDA). Similar work is also being done at Texas A and M University and USDA, ARS laboratory in Oklahoma.

The pigeonpea market is highly globalized, very competitive and dominated by India: the major producer and consumer. However, the market for it has been increasing outside Asian and Africa countries into Europe, the United States and Canada due to migration and increase in ethnic populations, especially in large cities. However, the Indian market still remains the largest (Rusike and Dimes, 2004). Work by Lucier, et al. (2000) shows increase in per capita bean consumption in the United States due to interest in ethnic foods cooked with dry beans and change in America's dietary awareness. The objective of this study is to assess the impact of spacing on yield and make exploratory evaluation of the market for the crop in the Nashville area.

## Materials and Method

This study was carried out on Tennessee State University Agricultural Research and Demonstration farm in 2006. A Complete Randomized Block Design (CRBD) with four replications. The four pigeonpea cultivars used were (Georgia 1, Georgia 2, W-1 and W-2). The first two cultivars are developed at University of Georgia and hence named accordingly while the latter two are merely designated as White seeded varieties. The seeds were planted using two types of row spacing (10ft x 10ft and 40ft x 40 inch). Land preparation was done and pre-emergence herbicide was applied for weed control. The soil type on the plot where the crop is planted is armour with its texture being armour silt loam. Soil test was done to determine the appropriate application rate of fertilizer and other inputs. During planting inoculant was used to enhance seed germination. The crop was manually harvested at different time intervals and shelled. Yield data for the different varieties was averaged. Analysis Of Variance (ANOVA) was used to assess the impact of spacing on the different pigeonpea cultivars and average yield per acre.

## Results and Discussion

Table 1 below provides average yield per acre in 2006 for the four varieties. It shows the yield is higher for all varieties when spacing is large.

**Table 1: Spacing and Yield Data**

Spacing	Treatment Variety	Average Yield/Acre (in lbs)
10ft x 10ft	Georgia 1	2035
	Georgia 2	995
	W-1	1054
	W-2	799
40ft x 40 inch x 4 rows by 3 replications	Georgia 1	2764
	Georgia 2	2253
	W-1	2216
	W-2	2834

Table 2 shows the results of analysis of the Data on the average yield per acre for each pigeonpea variety and spacing. It indicates that there is no significant difference between average yield per acre for pigeonpea varieties overall. The results also show that there is a significant difference between spacing. Finally, there is no significant interaction between varieties and spacing.

**Table 2: Result of Data Analysis**

ANOVA: Two-Factor With Replication						
SUMMARY	Georgia 1	Georgia 2	W-1	W-2	Total	
<i>10</i>						
Count	3	3	3	3	12	
Sum	6104	2986	3161	2398	14649	
Average	2034.666667	995.333333	1053.667	799.3333	1220.75	
Variance	253461.3333	11529.3333	360390.3	51484.33	373643.3	
<i>40</i>						
Count	3	3	3	3	12	
Sum	8293	6758	6649	8502	30202	
Average	2764.333333	2252.66667	2216.333	2834	2516.833	
Variance	1436356.333	1287108.33	241580.3	368311	693865.2	
<i>Total</i>						
Count	6	6	6	6		
Sum	14397	9744	9810	10900		
Average	2399.5	1624	1635	1816.667		
Variance	835651.1	993721.2	646326.4	1409879		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Sample	10078992.04	1	10078992	20.10661	0.000376	4.493998
Columns	2393699.125	3	797899.7	1.591732	0.230531	3.238872
Interaction	1328452.125	3	442817.4	0.883377	0.470619	3.238872
Within	8020442.667	16	501277.7			
Total	21821585.96	23				

Work by others support our finding that there is link between yield and spacing (for instance, see Faroda and Johri, 1981).

## Summary and Conclusions

Pigeonpea is a nutritious crop that has a number of other desirable qualities. These include its ability to fix nitrogen, grow on marginal lands and multipurpose use for human consumption, animal feed and fuel. The focus of this study was to examine the role of row spacing on yield and explore market potential of the crop. This study found that spacing affects yield. That is, the more the spacing the more the yield. India is the largest producer and consumer of the crop. However, there is growing interest to produce the crop by other countries including the United States. Some universities in the Southern region are engaged in studies involving the crop with funding support from various agencies including the United States Department of Agriculture. Market assessment for the crop was done by holding face to face meetings with managers of ethnic and other food stores as well as vendors at farmers market in the metro Nashville area. All

expressed their willingness to buy large quantities of the crop at competitive price. Thus, growing pigeonpea can provide opportunity for small farmers to earn addition income and supply healthy nutritious food for consumers.

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