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Performance of Three Chinese Peanut Cultivars Under Irrigated and Nonirrigated Conditions in Virginia[1]

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ABSTRACT

Three virginia-type peanut (*Arachis hypogaea* L.) cultivars from China--China 11 (PI 420334), China 17 (PI 433349), and China 27 (PI 420335), were compared to a U.S. virginia-type cultivar, Virginia 81 Bunch (VA 81B), for 2 years (1982 and 1983) in Virginia under irrigated and nonirrigated conditions for market grade, yield and value per hectare, seed germination, and nutrient content of the seed. In addition, Sclerotinia blight resistance ratings of the Chinese lines were taken in 1981. Under irrigated and nonirrigated conditions, China 11 was significantly higher in seed contents of Mg and Zn, sound mature kernels, total kernels, total sound mature kernels, seed germination, and significantly lower in seed weight than VA 81B, China 17 and China 27. China 17 and 27 were similar for all characters studied, except seed Zn. However, the U.S. developed cultivar, VA 81B, was still higher in yield than the Chinese lines. The Chinese lines all have a reduced bunch growth habit, which would probably limit their use in the United States to production systems with row widths of 0.6 m or less. China 11 may be a source of resistance to *Sclerotinia minor*. All three Chinese lines are a good source of early maturity. Irrigated plots were higher in seed Mg, P, Ca, and Cu; sound mature kernels; total kernels; total sound mature kernels; yield; value; seed germination; and Sclerotinia blight ratings. Nonirrigated plots were higher in seed K and Zn.

Key Words: *Arachis hypogaea* L., groundnuts, pod yield, market grade, macronutrients, micronutrients, germplasm, peanut breeding

China is the second largest peanut (*Arachis hypogaea* L.) producing country in the world. Until recently, germplasm from China was not readily available to peanut breeders in the United States. Peanut breeding programs in China have developed several new cultivars with many characteristics that would be desirable in United States cultivars (4). Some of these characteristics are early maturity, high yield, and disease resistance. This makes China an excellent source for new germplasm to widen the genetic base of new cultivares in the United States.

The objectives of this study were to evaluate three peanut introductions from China compared to a U.S. cultivar under irrigated and nonirrigated conditions in Virginia for characteristics that might be useful in U.S. peanut breeding programs. The characteristics studied were growth habit, maturity, market grade, yield and value per hectare, 100 seed weight, seed germination, seed nutrient content, and resistance to *Sclerotinia minor* Jagger, the causal agent of Sclerotinia blight.

Materials and Methods

The field experiments were conducted for 2 years (1982 and 1983) at Carrsville, Virginia, under irrigated and nonirrigated conditions. The soil type was a Norfolk loamy fine sand (fine-loamy, siliceous, thermic, typic paleudult). The four row plots were 1.8 m wide x 6.1 m long. Seed were planted 10 cm apart within each row. The row spacings were 41 cm and 61 cm within and among plots, respectively. The 61 cm middles were used for the wheels during all tractor passes through the field. Each test was arranged in a randomized complete block design with four replications. Data were analyzed by analyses of variance and Duncan's new multiple range test. Production practices recommended by the Virginia Cooperative Extension Service were used each year.

The three Chinese lines (China 11, 17, and 27) were previously introduced into the United States as PI 420334, PI 433349, and PI 420335, respectively. Virginia 81 Bunch (VA 81B) was used for comparing the Chinese cultivars to a U.S. cultivar. The market grade characteristics determined by USDA peanut marketing procedures each year were percentages of sound splits, damaged kernels, other kernels, sound mature kernels, total kernels, and total sound mature kernels. In addition, yield and value per hectare, 100 seed weight, seed germination, and nutrient content of the seed were determined both years. Nutrients determined were Ca, Mg, P, Cu, Mn, Zn, Fe, and K. Market grades, germination, and nutrient contents were determined according to standard procedures (2,3). Visual ratings (1 = no disease and 5 = dead plants) were made for damage due to Sclerotinia blight in 1981 for the Chinese cultivars.

Results and Discussion

Total moisture, rainfall plus irrigation, during the experimental period exceeded the normal rainfall for Virginia each year (Table 1). Supplemental irrigation was used at the irrigated locations three and five times in 1982 and 1983, respectively. Rainfall was adequate in 1982, but was below normal during critical plant growth stages during July and August, 1983.

Yields of the Chinese lines were high, but VA 81B was significantly higher yielding, especially at the nonirrigated locations (Table 2). China 11 was the most productive of the Chinese lines. Results from a preliminary test in 1981 indicated China 11 might serve as a source of resistance to *Sclerotinia minor*, but results are too limited in this study to be conclusive (Table 3).

The Chinese lines had a reduced bunch growth habit when grown in Virginia under both irrigated and nonirrigated conditions. This would probably limit their production in the United States to production systems with row widths of 0.6 m or less for obtaining maximum yields. This observation is supported by the low yields of these

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Table 1. Rainfall (R) and Irrigation (I) for 2 years during the peanut growing season in Virginia.

Month	Normal rainfall	1982		1983	
		R	I	R	I
	mm	mm	mm	mm	mm
May	97	188	0	97	0
June	114	66	0	135	0
July	152	173	33	76	76
Aug	152	112	33	66	114
Sept	107	84	33	99	0
Subtotal	622	623	99	473	190
Total	622	722		663	

Table 2. Means of market grade characters, yield, value, 100 seed weight, and germination at irrigated and nonirrigated locations for 2 years (1982 and 1983).

Factor	SMK	MEAT	TSMK	Yield	Value	100 Seed Weight	Germ
	%			kg ha^{-1}	\$ ha^{-1}	g	%
NONIRRIGATED							
Years							
1982	71 a[1]	76 a	73 a	3485 a	2296 a	74 a	94 b
1983	55 b	68 b	57 b	3240 b	1512 b	71 a	97 a
Cultivars							
China 11	67 a	76 a	70 a	3481 b	2002 a	65 b	99 a
China 17	62 b	71 b	64 b	3085 c	1712 b	76 a	92 c
China 27	62 b	72 b	65 b	3130 c	1752 b	73 a	96 b
VA 81B	61 b	68 c	62 c	3755 a	2152 a	74 a	95 b
IRRIGATED							
Years							
1982	69 a	75 a	71 a	3261 b	2093 b	68 b	97 a
1983	65 b	71 b	67 b	4474 a	2679 a	73 a	98 a
Cultivars							
China 11	71 a	76 a	73 a	4011 ab	2617 a	59 b	99 a
China 17	66 b	71 bc	68 b	3817 b	2310 b	74 a	98 a
China 27	66 b	72 b	68 b	3480 c	2098 c	74 a	97 a
VA 81B	65 b	71 c	67 b	4162 a	2515 ab	75 a	97 a
IRRIGATED & NONIRRIGATED							
Years							
1982	70 a	75 a	72 a	3373 b	2194 a	71 a	95 b
1983	60 b	69 b	62 b	3857 a	2095 b	72 a	98 a
Locations							
Irrigated	67 a	73 a	69 a	3867 a	2385 a	70 a	98 a
Nonirrigated	63 b	72 b	65 b	3363 b	1905 b	72 a	96 b
Cultivars							
China 11	69 a	76 a	71 a	3745 b	2308 a	62 b	99 a
China 17	64 b	72 b	66 b	3450 c	2011 b	75 a	95 b
China 27	64 b	72 b	66 b	3305 c	1925 b	74 a	96 b
VA 81B	63 b	69 c	65 c	3959 a	2335 a	74 a.	96 b

[1] Means within factors and columns not followed by the same letter are significantly different at the P=0.05 level according to Duncan's Multiple Range Test.

Table 3. Reaction in 1981 of 3 Chinese peanut cultivars to *Sclerotinia minor*, the causal organism of Sclerotinia blight.

Cultivar	Location: Nonirrigated	Location: Irrigated	Mean
China 11	1.2 b[1]	2.0 b	1.6 b
China 17	1.7 a	2.9 a	2.3 a
China 27	1.9 a	3.1 a	2.5 a
Mean	1.6 b	2.7 a	

[1] Means within columns not followed by the same letter are significantly different at the P=0.05 level according to Duncan's Multiple Range Test.

cultivars when planted in 0.9 m rows (Coffelt, unpublished) and the recommended row spacing of 0.4 m in China for growing these cultivars (O. K. Hobbs personal communication). The Chinese lines are all early maturing cultivars in Virginia. Based on visual observations, China 11 was the earliest maturing of the Chinese lines, maturing 5-7 days earlier than VA 81B and/or China 17 and 27.

On the basis of seed weight China 11 would be classified a runner type; and China 17 and 27, as virginia types in the United States marketing system (Table 2). China 11 was significantly higher in total kernels, sound mature kernels, total sound mature kernels, and germination than the other cultivars (Table 2). VA 81B was lower than the Chinese lines in meat, sound mature kernels, and total sound mature kernels, especially at the nonirrigated locations (Table 2). Results (not shown) for percentages of other kernels, damaged kernels, and sound splits were not significant for cultivars or locations, and were consistent with those expected for high quality peanuts.

The seed content of Ca, Cu, and Mn was significantly greater in China 17 and 27 than in VA 81B (Table 4). China 11 seed were generally higher in all of the nutrients than the seed of the other lines, and significantly higher in Mg and Zn (Table 4). Seed K, P, and Fe were significantly higher in 1982 than 1983, as were sound mature kernels, total kernels, total sound mature kernels, and value ha^{-1}. In contrast, seed Ca, Cu, and Mn; yield; and germination were significantly higher in 1983 than 1982. The higher percentages of meat, sound mature kernels, and total sound mature kernels in 1982 did not correspond to higher contents of any of the nutrients (Table 2 and 4).

Table 4. Mean seed nutrient contents at irrigated and nonirrigated locations for 2 years (1982 and 1983).

Factor	MG	K	P	CA	CU	MN	ZN	FE
	g kg^{-1}			mg kg^{-1}				
NONIRRIGATED								
Years								
1982	2.0 a[1]	8.2 a	3.9 a	425 a	9.0 b	17.1 a	39.8 a	23.5 a
1983	2.0 a	7.9 a	3.9 a	448 a	11.0 a	16.4 a	40.3 a	18.3 b
Cultivars								
China 11	2.1 a	7.9 a	3.9 a	463 a	11.2 a	18.8 a	45.7 a	25.1 a
China 17	1.9 b	7.8 a	3.8 a	457 a	10.4 ab	17.2 a	38.8 b	22.3 ab
China 27	2.0 b	8.0 a	4.0 a	453 a	10.2 b	16.7 a	38.1 b	17.7 b
VA 81B	1.9 b	8.4 a	3.9 a	371 b	8.2 c	14.4 b	37.7 b	18.6 b
IRRIGATED								
Years								
1982	2.2 a	7.7 a	4.1 a	630 b	10.6 a	13.1 b	35.7 a	23.3 a
1983	2.0 a	6.8 b	3.8 b	673 a	11.5 a	19.3 a	36.2 a	16.0 b
Cultivars								
China 11	2.4 a	7.2 a	4.2 a	727 a	11.6 a	17.8 a	41.8 a	20.2 a
China 17	2.0 b	7.1 a	3.9 b	670 ab	11.1 ab	16.1 ab	36.2 b	18.6 a
China 27	2.0 b	7.1 a	3.8 b	649 b	11.4 ab	17.5 a	33.4 c	20.4 a
VA 81B	2.0 b	7.4 a	4.0 ab	562 c	10.2 b	13.5 b	32.5 c	19.4 a
IRRIGATED & NONIRRIGATED								
Years								
1982	2.1 a	7.9 a	4.0 a	528 b	9.8 b	15.1 b	37.8 a	23.4 a
1983	2.0 a	7.3 b	3.8 b	560 a	11.3 a	17.9 a	38.3 a	17.2 b
Locations								
Irrigated	2.1 a	7.2 b	4.0 a	652 a	11.1 a	16.2 a	36.0 b	19.6 a
Nonirrigated	2.0 b	8.1 a	3.9 b	436 b	10.0 b	16.8 a	40.1 a	20.9 a
Cultivars								
China 11	2.3 a	7.6 a	4.0 a	595 a	11.4 a	18.3 a	43.8 a	22.6 a
China 17	2.0 b	7.5 a	3.9 b	563 ab	10.7 a	16.7 a	37.5 b	20.5 a
China 27	2.0 b	7.6 a	3.9 ab	551 b	10.8 a	17.1 a	35.8 c	19.0 a
VA 81B	1.9 b	7.9 a	4.0 ab	466 c	9.2 b	14.0 b	35.1 c	19.0 a

[1] Means within factors and columns not followed by the same letter are significantly different at the P=0.05 level according to Duncan's Multiple Range Test.

As in previous irrigation studies in Virginia (5,6), nonirrigated plots yielded more than irrigated plots 1 out of 2 years (Table 2). This may be partially explained by the greater occurrence of diseases in irrigated than nonirrigated plots, since irrigation greatly enhances most disease problems in Virginia (5). In a preliminary evaluation in 1981, irrigated and nonirrigated plots had yields of 4006 kg ha^{-1} and 4753 kg ha^{-1}and Sclerotinia blight ratings of 2.7 and 1.6, respectively (Table 3).

Irrigated plots were significantly higher in seed Mg, P, Ca, and Cu; sound mature kernels; total kernels; total sound mature kernels; germination; yield; and value (Tables 2 and 4). Nonirrigated plots were significantly higher in seed contents of K and Zn (Table 4). Higher Ca contents have been associated with higher germination (1,2). Therefore, an irrigation after applying landplaster may help ensure adequate seed calcium for good germination.

While their reduced growth habit would probably prevent the Chinese lines from being grown by most U.S. peanut producers, they should be useful in breeding programs for developing cultivars with early maturity, high meat contents, and high seed nutrient contents. In addition, China 11 may also serve as a potential source of resistance to Sclerotinia blight.

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