

Research progress report
Marker-assisted selection to facilitate peanut cultivar development

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The plan of integrating high oleic and nematode resistance traits into elite cultivars proposed for 2009 funding period was carried out. It was proposed to use molecular markers to screen F₂ of C1804 (Tifguard x Georgia 02C) and C1805 (Tifguard x Florida 07). A total of 1,140 F₂ plants were screened with both nematode resistance and high oleic:linoleic acid (O/L) markers. Forty five homozygotes for both traits were identified. In this process, a high throughput DNA extraction method was adopted to increase the efficiency of genotyping. A codominant SSR marker GM565 developed by Dr. Steve Knapp's lab (Molecular Breeding in press) was used to detect homozygosity for the nematode resistance trait. Ten F₃ seeds from each of the eleven high yield homozygous F₂ plants were tested further with markers for both traits and 94% were homozygous for both traits which validates the genotype data collected for the F₂ population. 4% of the seeds were heterozygous for both traits and 2% for only nematode resistance, suggesting a low level of outcrossing in this field-grown material. Oil composition of these seeds will be determined by GC measurement. Another ten seeds from each of these F₂ plants have been sown in the greenhouse to test for nematode resistance. The association of phenotype and genotype data will provide strong evidence for the efficiency of this MAS system. It was also proposed to generate high O/L Tifguard by backcrosses (Table 1). All of the female Tifguard parents were screened for homozygosity of nematode resistance markers. BC₁ plants were tested by markers for both traits and the ones that possessed the ideal trait combinations were selected as the male parents for backcrosses. The 74 seeds from BC₃ will be germinated, selfed and their progeny selected for homozygous high O/L Tifguard. We are currently on schedule to produce this new cultivar in 26 months.

A second objective was to advance a population of Gregory x Tifguard for mapping of TSWV resistance and seed traits using SSR and SNP markers. F₈ seeds have been harvested and F₈ plant material will be collected for molecular analysis. Phenotypic data such as pod count, seed weight, and seed coat color were collected on F₇ pods/seeds and will be verified in the F₈ generation.

The third objective was to search for novel ahFAD2 mutations by TILLING. While five mutations have been identified in the TILLING population screened to date, only three are novel and not predicted to cause a change in enzyme structure or activity. The other two are in the same position as the spontaneous mutations already present in peanut germplasm and should be functional mutations.

Table 1. Summary of high oleic Tifguard backcross project

	Cross #	Parents	# of seeds	# of ideal seeds	Ideal trait combination
Initial cross	C1804	Tifguard x Georgia 02C	17	14	O/L: Ht; NEMR: Ht
	C1805	Tifguard x Florida 07	18	15	O/L: Ht; NEMR: Ht
Backcross 1	C1806	Tifguard x F1: C1804	8	4	O/L: Ht; NEMR: Hm
	C1815	Tifguard x F1: C1805	9	2	O/L: Ht; NEMR: Hm
Backcross 2	C1939	Tifguard x BC1: C1806	8	1	O/L: Ht; NEMR: Hm
	C1940	Tifguard x BC1: C1815	8	4	O/L: Ht; NEMR: Hm
Backcross 3	C1975	Tifguard x BC2: C1939	21		
	C1976	Tifguard x BC2: C1940	53		

Ht: heterozygous; Hm: homozygous