Relative Ranking and Risk to Sustainability of Pest Management Tools in the Virginia-Carolina Region of the United States

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INTRODUCTION

The combination of cultivar and effective production and pest management practices are important in optimizing yield and economic return of peanut. Breeding programs often focus on resistance to pathogens, viruses, and nematodes; improving the fatty acid profile; selecting for pod and kernel characteristics for specific markets; and increasing yield. Traits that have been introgressed into peanut for improved insect management, nutrient use efficiency, and other limitations to successful peanut production are not a focus of genetic and breeding programs or have not been significant components of public or commercial variety development programs. Farmers use cultural practices, cultivars, and chemicals (synthetic pesticides and fumigants) in an attempt to maintain pest incidence and subsequent injury below economically-damaging levels in the Virginia-Carolina region of the US. Many factors influence effectiveness and availability of cultural and chemical controls and cultivars available to farmers. In this poster we discuss the major sources of pest management; the risk of maintaining these resources (evolution of pest resistance, maintaining and developing new and crop protection materials); and acceptance of pesticides in both domestic and international markets.

APPROACH

The major pests in the Virginia-Carolina region were ranked according to impact on individual plants and effects of pests on yield either with or without management based on current Cooperative Extension recommendations. The relative importance of cultural practices, cultivars, and chemicals were compared. Risk to sustainability of pest management practices and a ranking of the reasons for risk (evolved resistance, registrations, and agribusiness investment) were ranked. Ultimately, these results provide comparisons of strategies that are being addressed through genetics and breeding and cultural and chemical management and are a reminder of the vulnerability associated with pests in the region.

RESULTS

Of the 19 pests or groups of pests considered, chemicals were the primary tool for management (4 groups of weeds, 4 groups of arthropods, and 4 pathogens or viruses for disease) (Tables 1-3). Cultivar resistance was listed as the primary tool for black root rot while cultivar was considered a close second in terms of management tools for tomato spotted wilt, leaf spot, stem rot, and Sclerotinia blight. Cultural practices including crop rotation, plant population, planting date, and irrigation were primary tools for tomato spotted wilt suppression while crop rotation was essential for nematode management. Risk to sustainability of management through chemicals for leaf spot, corn rootworm, and thrips was listed as moderate to high while spider mites, Palmer amaranth, and common ragweed were listed as being at high risk for chemical management (Tables 4-6). Evolved resistance by pests was a major source of risk for maintaining chemical control for caterpillars and worms, common ragweed, Palmer amaranth, seedling disease, and thrips. Other resources that could partially impact availability of tools for pest control included registrations, international acceptance of residues in peanut products, and manufacturer investment.

SUMMARY

While this summary points to the value of genetics and breeding in sustaining peanut yield in the Virginia-Carolina region, the summary also suggests that many of the pests that limit yield require significant integration of cultural practices and chemicals for yield maintenance and possible increases. Farmers use a wide range of practices to manage a broad spectrum of biotic and abiotic practices to protect yield. Moving forward, research programs will need to explore new approaches to managing pests, especially where key tools are vulnerable, in particular pesticides and fumigants, and where cultivars currently have limited impact.

Table 1. Relative ranking of pathogens and virus impact on peanut yield, and methods of pest suppression.[1]

	Ranking of greatest negative impact (1) to least important with respect to peanut yield			Method of pest suppression		
Pest	**Individual plant**	**Without control**	**With control**	**Cultural[a]**	**Cultivar**	**Chemical**
Black root rot	2	6	6	3[a,c]	1	2
Tomato spotted wilt	6	4	2	1[a,b,c,d]	2	3
Leaf spot	3	2	1	3[a,c,d,e]	2	1
Stem rot	4	3	5	3[a,b,c,d,e]	2	1
Sclerotinia blight	5	5	3	3[a,b,c,e]	2	1
Seedling disease	1	1	1	2[a,c]	3	1
Nematodes	6	6	4	1[a]	3	2
Aspergillus flavus	7	7	7	1[b,c,e,f]	2	3

[1]Cultural practices include: [a]Crop rotation, [b]Plant population, [c]Planting date, [d]Tillage, [e]Irrigation, and [f]Fertility.

Table 2. Relative ranking of arthropods on peanut yield, and methods of pest suppression.[1]

	Ranking of greatest negative impact (1) to least important with respect to peanut yield			Method of pest suppression		
Pest	**Individual plant**	**Without control**	**With control**	**Cultural[a]**	**Cultivar**	**Chemical**
Thrips	3	1	2	2[b,c,d]	3	1
Corn rootworm	5	2	4	2[c,d,e]	3	1
Caterpillars and worms	6	3	5	2[e]	3	1
Lesser cornstalk borer	1	5	3	2[d,e]	3	1
Burrower bug	4	6	6	1[d,e]	3	2
Mites	2	4	1	2[e]	3	1

[1]Cultural practices include: [a]Crop rotation, [b]Plant population, [c]Planting date, [d]Tillage, [e]Irrigation, and [f]Fertility.

Table 3. Relative ranking of weeds on peanut yield, and methods of pest suppression.[1]

	Ranking of greatest negative impact (1) to least important with respect to peanut yield			Method of pest suppression		
Pest	**Individual plant**	**Without control**	**With control**	**Cultural[a]**	**Cultivar**	**Chemical**
Palmer amaranth	1	2	1	2[a,b,d,e]	3	1
Common ragweed	2	1	2	2[a,b,c,d,e]	3	1
Grasses	3	3	3	2[a,b,c,d,e]	3	1
Sedges	4	4	4	2[a,b,c,d,e]	3	1
Other	4	4	4	2[a,b,c,d,e]	3	1

[1]Cultural practices include: [a]Crop rotation, [b]Plant population, [c]Planting date, [d]Tillage, [e]Irrigation, and [f]Fertility.

Table 4. Risk to sustainability of the most important method of pathogen and virus suppression.[a]

		Pesticides			
Disease caused by pathogen or virus	**Risk level[a]**	**Evolved resistance**	**Registrations**	**International acceptance**	**Manufacturer investment**
Black root rot	L	1	-	-	-
Tomato spotted wilt	L	1	-	-	-
Leaf spot	M-H	1	3	2	4
Stem rot	L-M	2	1	4	3
Sclerotinia blight	L	3	3	2	1
Seedling disease	M	1	2	3	4
Nematodes	L	2	1	4	3
Aspergillus flavus	L	-	-	-	-

[a]Abbreviations: L, low; M, moderate; H, high.

Table 5. Risk to sustainability of the most important method of arthropod suppression.[a]

		Pesticides			
Disease caused by pathogen or virus	**Risk level[a]**	**Evolved resistance**	**Registrations**	**International acceptance**	**Manufacturer investment**
Thrips	M-H	1	2	3	4
Corn rootworm	M-H	3	1	4	2
Caterpillars and worms	M	1	2	3	4
Lesser cornstalk borer	L-M	3	2	4	1
Burrower bug	L-M	3	2	4	1
Mites	L-M	3	2	4	1

[a]Abbreviations: L, low; M, moderate; H, high.

Table 6. Risk to sustainability of the most important method of weed suppression.[a]

		Pesticides			
Disease caused by pathogen or virus	**Risk level[a]**	**Evolved resistance**	**Registrations**	**International acceptance**	**Manufacturer investment**
Palmer amaranth	H	1	2	4	3
Common ragweed	M-H	1	2	4	3
Grasses	M	2	1	4	3
Sedges	L	3	1	4	2
Other	L	3	1	4	2

[a]Abbreviations: L, low; M, moderate; H, high.