

Examples of Risk Tools for Pests in Peanut (*Arachis hypogaea*) Developed for Five Countries Using Microsoft Excel

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Abstract

Suppressing pest populations below economically-damaging levels is an important element of sustainable peanut (*Arachis hypogaea* L.) production. Peanut farmers and their advisors often approach pest management with similar goals regardless of where they are located. Anticipating pest outbreaks using field history and monitoring pest populations are fundamental to protecting yield and financial investment. Microsoft Excel was used to develop individual risk indices for pests, a composite assessment of risk, and costs of risk mitigation practices for peanut in Argentina, Ghana, India, Malawi, and North Carolina (NC) in the United States (US). Depending on pests and resources available to manage pests, risk tools vary considerably, especially in the context of other crops that are grown in sequence with peanut, cultivars, and chemical inputs. In Argentina, India, and the US where more tools (e.g., mechanization and pesticides) are available, risk indices for a wide array of economically important pests were developed with the assumption that reducing risk to those pests likely will impact peanut yield in a positive manner. In Ghana and Malawi where fewer management tools are available, risks to yield and aflatoxin contamination are presented without risk indices for individual pests. The Microsoft Excel platform can be updated as new and additional information on effectiveness of management practices becomes apparent. Tools can be developed using this platform that are appropriate for their geography, environment, cropping systems, and pest complexes and management inputs that are available. In this article we present examples for the risk tool for each country.

Key words: agronomy, crop rotation, cultivar resistance, decision tool, IPM-Agriculture, pesticide

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LOW MODER/	HIGH		
270	570 1245		
165 270	570 1345		
Crop\Planting Date		Risk	Points
Apr 15 to Apr 30, Jul 15 to	Aug 30	100	
Jul 01 to Jul 14		80	20
May 01 to May 14, May 15	to May 31*, Jun 01 to Jun 14	20	
Crop\Plants per 1m of Row		Risk	Points
Broadcast (Variable Rate)		60	
4 plants (25 cm spacing)		20	
5 plants (20 cm spacing) 7 plants (15 cm spacing)		10	3
10 plants (10 cm spacing, o	ptimum)	5	
Crop\Seed Inoculant		Risk	Points
No		25	5
Yes*		5 Bick	Dointe
Chinese (Span), Sarinut 1 ()	/ir-LSR.GRDR)*	15	ronnes
Kpanieli (Vir-LSR,GRDR), N	katisesari (Vir-LSR), Sarinut 2 (Span-LSR), Yenyawoso (Span-GRDR)	5	12
Field\Calciprill Application		Risk	Points
No Vor*		100	5
Field\Crop Rotation		Risk	Points
Groundnut : Groundnut : G	roundnut	80	
Soybean : Groundnut : Gro	undnut	60	
Groundnut : Maize : Groun	dnut, Groundnut : Sorghum : Groundnut, Soybean : Maize : Groundnut	50	5
Soybean : Soybean : Groundout	dnut * Maize · Sorghum · Groundaut · Sorghum · Maize · Groundaut	40	
Field\Fertilizer	, mare . soignum . orounding, soignum . mare . orounding	Risk	Points
None		80	
50 kg/ha (Yara Legume)		40	15
100 kg/ha (Yara Legume)*		15	
Field\Soil Fertility	200 kg/na (tara Legume), 250 kg/na (tara Legume)	Risk	Points
Low		20	
Moderate*		0	0
High		-20	Delate
A 4 or lower 7 0 or higher		Kisk 50	Points
4.5 to 5.0		30	
5.1 to 5.5		20	5
5.6 to 6.9*		5	
Field\Tillage		Risk	Points
Plough and harrow (Improv	ved)*	10	10
Harvest\Digging Timimg		Risk	Points
21 Days Early, 21 Days Late		150	
14 Days Late		120	20
14 Days Early 7 Days Early 7 Days Late		30	20
Optimum*		20	
Harvest\Drying		Risk	Points
Ground		160	
Cemented floor		50	10
Pest Management\Aphid Spr	av	Risk	Points
No	-1	10	
Yes*		5	3
Pest Management\Bird Prote	ction	Risk	Points
No Ves*		25	5
Pest Management\Fungicides		Risk	Points
None*		60	
1 Spray		40	60
2 Sprays		20	
3 Sprays Pest Management\Rodent Pr	atertion	Rick	Points
No	orection	20	Fontes
Yes*		5	5
Pest Management\Weed Con	ntrol	Risk	Points
1 hand weeding during sea	son, 3 hand weedings during season	50	20
2 nano weedings during se Pre herbicides followed by	ason , rost nerbicides followed by I nand weeding 1 hand weeding	20	20
Storage\Groundnut Moisture		Risk	Points
Greater than 15%		80	
10 to 15%*		20	20
Less than 10%		5 Plat	Doint
Traditional		160	romus
		20	20
Sealed*			
Sealed* Storage\Temperature		Risk	Points
Sealed* Storage\Temperature Higher than 32 *C		Risk 80	Points

* Selected options used in calculating pest risk. Note: Reduction in pest risk value by a control practice will be less under low risk conditions.

Fig. 1. Risk summary for aflatoxin contamination in the northern Ghana peanut risk tool.

Peanut (*Arachis hypogaea* L.) is an important crop in many regions of the world and contributes to food security due to the resilience it adds in cropping systems and positive contributions to the human diet (Stalker et al. 2016, Valentine 2016). However, peanut is susceptible to a wide range of biotic and abiotic stresses that can limit yield

and quality and create issues associated with food safety (Nigam et al. 2018, Jordan et al. 2018). Low yield and poor quality can affect financial sustainability of peanut-based cropping systems. Employing cost-effective practices to minimize the impact of pests can increase peanut yield and financial sustainability. Research and

Bit 170 550 Crop\Planting Date Jul 15 to Aug 30 Apr 15 to Ayr 30, Jul 01 to Jul 14 May 01 to May 14, Jun 15 to Jun 30 May 15 to May 31*, Jun 01 to Jun 14 Crop\Plants per 1m of Row Broadcast (Variable Rate) 4 plants (25 cm spacing) 5 plants (25 cm spacing) 5 plants (25 cm spacing) 10 plants (15 cm spacing) 10 plants (15 cm spacing) 10 plants (15 cm spacing, optimum) Crop\Plants per 1m of Row Row Yes* CropVariety Chinese (Span) Nikatiseari (Vir-LSR, Strinut 2 (Span-LSR), Yenyawoso (Span-GRDR) Kpanieli (Vir-LSR, GRDR), Sarinut 1 (Vir-LSR, GRDR)* Field\Calciprill Application No Yes* Field\Calciprill Application No Yes* Field\Calciprill Application No Yes* Field\Calciprill Application None Solybean : Groundnut : Groundnut : Sorgunm : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut # Maize : Sorgunm : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut # Maize : Sorgunm : Groundnut, Sorghum : Maize : Groundnut Solg/ha (Yara Legume)	1220 Risk 100 80 00 10 Risk 160 60 20 10 5 Risk 155 Risk 70 10 5 Risk 5 8 8 8 5 7 8 8 8 5 7 8 8 8 5 7 8 8 8 5 7 8 8 8 5 7 8 8 8 5 7 8 8 8 5 7 8 8 8 5 7 8 8 8 8 7 9 10 10 10 10 10 10 10 10 10 10	Points 10 Points 5 Points 5 Points 5 Points 5 Points 5 Points 0
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Yes* Yes* Crop/Variety Chinese (Span) Nkatiseari (Vir-LSR), Sarinut 2 (Span-LSR), Yenyawoso (Span-GRDR) Kapanieli (Vir-LSR, GRDR), Sarinut 1 (Vir-LSR, GRDR)* Feld/Calciprill Application No Yes* Field/Crop Rotation Groundnut : Groundnut : Groundnut Soybean : Groundnut : Groundnut Soybean : Groundnut : Groundnut Groundnut : Maize : Groundnut : Sorghum : Groundnut, Soybean : Maize : Groundnut Maize : Maize : Groundnut, Groundnut : Sorghum : Groundnut, Soybean : Maize : Groundnut Field/Crol Rotation Soken : Groundnut : Maize : Sorghum : Groundnut, Soybean : Maize : Groundnut Groundnut : Maize : Groundnut : Sorghum : Groundnut, Soybean : Maize : Groundnut Maize : Maize : Groundnut, Groundnut : Sorghum : Groundnut, Soybean : Maize : Groundnut Goudrate : Maize : Groundnut : Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Cow Moderate* High 4.4 or lower, 7.0 or higher 4.5 to 5.0 S.1 to 5.5 S.6 to 6.9*	5 Risk 70 10 5 Risk 50 40 40 35 15 5 Risk 100 50 0 0 0 50 0 0 0 50 0 0 0 0 0 0 0	5 Points 5 Points 5 Points 5 Points 0
Crop\Variety Chinese (Span) Nkatisesari (Vir-LSR), Sarinut 2 (Span-LSR), Yenyawoso (Span-GRDR) Kasisesari (Vir-LSR, GRDR), Sarinut 1 (Vir-LSR, GRDR)* Field\Calciprill Application No Yes* Field\Corp Rotation Groundnut : Groundnut : Groundnut Soybean : Groundnut : Groundnut Groundnut : Groundnut : Groundnut Maize : Maize : Groundnut, Groundnut : Sorghum : Groundnut, Soybean : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Soybean : Maize : Groundnut Field\Sertilize None So kg/ha (Yara Legume) 100 kg/ha (Yara Legume) 200 kg/ha (Yara Legume) 200 kg/ha (Yara Legume) 200 kg/ha (Yara Legume) Eidd\Soil Fertility Low Moderate* High 4.4 or lower, 7.0 or higher 4.5 to 5.0 5.6 to 6.9*	Risk 70 10 5 Risk 50 40 35 15 5 Risk 100 50 0 0 50 -50 -50 -100 -150 Risk	Points 5 Points 5 Points 5 Points 0
Chinese (Span) Nkatisesari (Vir-LSR), Sarinut 2 (Span-LSR), Yenyawoso (Span-GRDR) Kpanieli (Vir-LSR, GRDR), Sarinut 1 (Vir-LSR, GRDR)* Field\Calcipiil Application No Yes* Field\Cang Rotation Groundnut : Groundnut : Groundnut Soybean : Groundnut : Groundnut Soybean : Groundnut : Groundnut Groundnut : Maize : Groundnut Groundnut : Maize : Groundnut, Sorghum : Groundnut, Soybean : Maize : Groundnut Maize : Maize : Groundnut, Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut, Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut, Young (Yara Legume) 100 kg/ha (Yara Legume) 100 kg/ha (Yara Legume) 200 kg/ha (Yar	70 10 5 Risk 50 35 Risk 15 5 Risk 100 50 0 -50 -50 -100 -150 Risk	5 Points 5 Points Points 0
Nkatisesari (Vir-LSR, Sarinut 2 (Span-LSR), Yenyawoso (Span-GRDR) Kpanieli (Vir-LSR, GRDR), Sarinut 1 (Vir-LSR, GRDR)* Field\Caliprill Application No Yes* Field\Crop Rotation Groundnut : Groundnut : Groundnut Soybean : Groundnut : Groundnut Soybean : Groundnut : Groundnut Groundnut : Maize : Groundnut Groundnut : Maize : Groundnut, Sorghum : Groundnut, Soybean : Maize : Groundnut Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Haize : Groundnut *, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Field\Fertilizer None S0 kg/ha (Yara Legume) 100 kg/ha (Yara Legume) 100 kg/ha (Yara Legume) 200 kg/ha (Yara Legume) 200 kg/ha (Yara Legume) 200 kg/ha (Yara Legume) 200 kg/ha (Yara Legume) 150 kg/ha (Yara Legume) 150 kg/ha (Yara Legume) 200 kg/ha (Yara Legume) 160 Kg/ha (Yara Legume) 150 kg/ha (Yara Leg	10 5 Risk 50 5 8 8 10 35 15 5 8 8 8 8 8 100 50 0 0 -50 -100 -150 Risk	5 Points 5 Points 5 Points 0
Kpanieli (Vir-LSR,GRDR), Sarinut 1 (Vir-LSR,GRDR)* Field\Calciprill Application No Yes* Field\Cycop Rotation Groundnut : Groundnut : Groundnut Soybean : Groundnut : Groundnut Soybean : Groundnut : Groundnut Maize : Maize : Groundnut, Groundnut : Sorghum : Groundnut, Soybean : Maize : Groundnut Maize : Maize : Groundnut, Groundnut : Sorghum : Groundnut, Soybean : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Solg/ha (Yara Legume) 100 kg/ha (Yara Legume)* 100 kg/ha (Yara Legume) 200 kg/ha (Yar	5 Risk 50 5 Risk 50 40 35 15 5 Risk 100 50 0 0 -50 -100 -150 Risk	Points 5 Points 5 Points 0
No Yes* iield/Crop Rotation Groundnut : Groundnut : Groundnut Soybean : Groundnut : Groundnut Soybean : Soybean : Groundnut Soybean : Soybean : Groundnut Groundnut : Maize : Groundnut, Groundnut : Sorghum : Groundnut, Soybean : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Haize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Groundnut : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Haize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Haize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Howe : Mokera Legume) 100 kg/ha (Yara Legume) 200 kg/ha	(iss 50 50 5 7 8 1 5 1 5 8 8 1 5 8 1 5 8 1 5 7 8 1 5 0 0 0 50 0 50 -100 -150 8 18 8 100 100 100 100 100 100 100 100	Points 5 Points 5 Points 0
Yes* Yes* iield\Crop Rotation Groundnut : Groundnut : Groundnut Soybean : Groundnut : Groundnut Soybean : Soybean : Groundnut Groundnut : Maize : Groundnut Groundnut : Maize : Groundnut : Sorghum : Groundnut, Soybean : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut So kg/ha (Yara Legume) 100 kg/ha (Yara Legume) 200 kg	50 5 Risk 50 40 35 15 5 Risk 100 50 0 50 -50 -50 -100 -150 Risk 100	5 Points 5 Points 0
<pre>ield\Crop Rotation Groundnut : Groundnut : Groundnut Soybean : Groundnut : Groundnut Soybean : Groundnut : Groundnut Groundnut : Maize : Groundnut Groundnut : Maize : Groundnut, Groundnut : Sorghum : Groundnut, Soybean : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Groundnut*, Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Groundnut*, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Groundnut*, Groundnut, Sorghum : Maize : Groundnut Maize : Maize : Groundnut*, Groundnut*, Groundnut, Sorghum : Maize : Groundnut Sorghum : Maize : Groundnut*, Groundnut*, Groundnut, Sorghum : Maize : Groundnut Sorghu*, Maize : Groundnut*, Groundnut*, Groundnut, Sorghum : Maize : Groundnut Ground : Groundnut*, Maize : Groundnut*, Ground*, Ground</pre>	Risk 50 40 35 15 5 Risk 100 50 0 -50 -50 -100 -150 Risk 100	Points 5 Points 0
Groundnut : Groundnut : Groundnut Soybean : Groundnut : Groundnut Soybean : Soybean : Groundnut Groundnut : Maize : Groundnut, Sorghum : Groundnut, Soybean : Maize : Groundnut Maize : Maize : Groundnut, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut ield/Fertilizer None So kg/ha (Yara Legume) 100 kg/ha (Yara Legume) 100 kg/ha (Yara Legume) 200 kg/ha (Y	50 40 35 15 5 8 16 10 0 50 -50 -100 -150 Risk 100	5 Points 0
Soybean : Groundnut : Groundnut Soybean : Soybean : Groundnut Groundnut : Maize : Groundnut, Groundnut : Sorghum : Groundnut, Soybean : Maize : Groundnut Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut ield\Fertilizer None 50 kg/ha (Yara Legume) 100 kg/ha (Yara Legume) 100 kg/ha (Yara Legume) 200 kg/ha (Yara Leg	40 35 15 5 Risk 100 50 0 -50 -100 -150 Risk	5 Points 0
Soybean : Soybean : Groundnut Groundnut : Maize : Groundnut, Groundnut : Sorghum : Groundnut, Soybean : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut ield\Fertilizer None 50 kg/ha (Yara Legume) 100 kg/ha (Yara Legume) 100 kg/ha (Yara Legume) 200 kg/ha (Yara Leg	35 15 5 Risk 100 50 0 -50 -100 -150 Risk 100	5 Points 0
Groundnut : Maize : Groundnut, Groundnut : Sorghum : Groundnut, Soybean : Maize : Groundnut Maize : Maize : Groundnut*, Maize : Sorghum : Groundnut, Sorghum : Maize : Groundnut Field\Fertilizer None 50 kg/ha (Yara Legume) 100 kg/ha (Yara Legume)* 150 kg/ha (Yara Legume)* 250 kg/ha (Yara Legume) 250 kg/ha (Yara Legume) 260 kg/ha (Yara Legume) 260 kg/ha (Yara Legume) 275 kg/ha (Yara Legume) 280 kg/ha (Yara Legume	15 5 Risk 100 50 0 -50 -100 -150 Risk 100	Points 0
Maize : Maize : Groundnut", Maize : Sorgnum : Groundnut, Sorgnum : Maize : Groundnut None 50 kg/ha (Yara Legume) 100 kg/ha (Yara Legume) 200 k	5 Risk Risk 50 50 -50 -100 -150 Risk 100	Points 0
None 50 kg/ha (Yara Legume) 100 kg/ha (Yara Legume) 100 kg/ha (Yara Legume) 200 kg/ha (Yara Legume) 250 kg/ha (Yara Legume) 260 kg/ha (Yara	100 50 -50 -100 -150 Risk 100	0
50 kg/ha (Yara Legume) 100 kg/ha (Yara Legume)* 150 kg/ha (Yara Legume) 200 kg/ha (Yara Legume) 250 kg/ha (Yara Legume) 260 kg/ha (Yara Legume) 260 kg/ha (Yara Legume) 260 kg/ha (Yara Legume) 200 kg/ha (Yara Legum	50 0 -50 -100 -150 Risk 100	0
100 kg/ha (Yara Legume)* 150 kg/ha (Yara Legume) 200 kg/ha (Yara Legume) 250 kg/ha (Yara Legume) ield\Soil Fertility Low Moderate* High ield\Soil pH 4.4 or lower, 7.0 or higher 4.5 to 5.0 5.1 to 5.5 5.6 to 6.9*	0 -50 -100 -150 Risk 100	0
150 kg/ha (Yara Legume) 200 kg/ha (Yara Legume) 250 kg/ha (Yara Legume) ield/Soil Fertility Low Moderate* High ield/Soil pH 4.4 or lower, 7.0 or higher 4.5 to 5.0 5.1 to 5.5 5.6 to 6.9*	-50 -100 -150 Risk 100	U
200 kg/ha (Yara Legume) 250 kg/ha (Yara Legume) ield\Soil Fertility Low Moderate* High ield\Soil pH 4.4 or lower, 7.0 or higher 4.5 to 5.0 5.1 to 5.5 5.6 to 6.9*	-100 -150 Risk 100	
250 Kg/ha (Yara Legume) ield\Soil Fertility Low Moderate* High ield\Soil pH 4.4 or lower, 7.0 or higher 4.5 to 5.0 5.1 to 5.5 5.6 to 6.9*	-150 Risk 100	
Low Moderate* High ield/Soil pH 4.4 or lower, 7.0 or higher 4.5 to 5.0 5.1 to 5.5 5.6 to 6.9*	100	Dointe
Moderate* High ield\Soil pH 4.4 or lower, 7.0 or higher 4.5 to 5.0 5.1 to 5.5 5.6 to 6.9*	100	Points
High ield\Soil pH 4.4 or lower, 7.0 or higher 4.5 to 5.0 5.1 to 5.5 5.6 to 6.9*	50	50
ield\Soil pH 4.4 or lower, 7.0 or higher 4.5 to 5.0 5.1 to 5.5 5.6 to 6.9*	5	
4.4 or lower, 7.0 or higher 4.5 to 5.0 5.1 to 5.5 5.6 to 6.9*	Risk	Points
4.5 to 5.0 5.1 to 5.5 5.6 to 6.9*	100	
5.1 to 5.5 5.6 to 6.9*	50	5
5.6 (0 6.9"	25	
ield Tillage	Pick	Points
Flat Beds (Conventional)	20	
Plough and harrow (Improved)*	10	10
larvest\Digging Timimg	Risk	Points
21 Days Early	100	
21 Days Late	70	-
14 Days Early, 14 Days Late	30	5
Ontinum*	10	
Vest Management\Aphid Spray	Risk	Points
No	80	
Yes*	5	3
Pest Management\Bird Protection	Risk	Points
NO Vor*	50	5
Tes"	Risk	Points
None*	100	
1 Spray	60	100
2 Sprays	20	100
3 Sprays	5	
rest Management\Rodent Protection	Risk	Points
NO Voc®	25	5
est Management\Weed Control	Risk	Points
1 hand weeding during season	100	
2 hand weedings during season*	30	
3 hand weedings during season	20	30
Post herbicides followed by 1 hand weeding		

* Selected options used in calculating pest risk.

Note: Reduction in pest risk value by a control practice will be less under low risk conditions.

Fig. 2. Risk summary for yield in the northern Ghana peanut risk tool.

educational programs by the public institutions, the private sector, and nongovernmental organizations often provide solutions to pests that adversely affect the peanut crop. Many of these solutions are developed locally with an understanding of the financial impact of pests and use of interventions that are available and economically practical.

Even though effective strategies and tools are available to suppress pests in peanut, information about those strategies is often

Crop				Production		Index	Low	Med	High
Planting Date Plants per 1m of Row Seed Inoculant Variety Field Calciprill Application Crop Rotation Fertilizer Soil Fertility	May 15 10 plants (10 cm spacing, Yes Sarinut 1 (Vir-LSR,GRDR Yes Maize : Maize : Groundnut 100 kg/ha (Yara Legume) Moderate	CROP\VARIETY Chinese (Span) Kpanieli (Vir-LSR,GRDR) Khatisesari (Vir-LSR) Sarinut 1 (Vir-LSR,GRDR) Sarinut 2 (Span-LSR) Yenyawoso (Span-GRDR)	×	Aflatoxin Yield Reductio Red Dots - Chang Yellow Dots - Cor Green Dots - Risk	e practices to elimin nsider adjusting prac is acceptable for se Estimated Cc	ate. tices to relected pro-	educe risk. actices. a): 3123		ngn
Soil pH	6.0								
Tillage	Plough and harrow (Improv	/ed)			1.020	0.70		676	4.505
Harvest				0	1,838	2,75	5/ 3,	6/6	4,595
Digging Timimg	Optimum								
Drying	Tarpulin			Create Production Log					
Pest Management									
Aphid Spray	Yes								
Bird Protection	Yes								
Fungicides	None								
Rodent Protection	Yes								
Weed Control	2 hand weedings during se	ason							
Storage									
Groundnut Moisture	10 to 15%								
Method	Sealed								
Temperature	Lower than 28 °C								

Fig. 3. Drop down menu for varieties in the northern Ghana peanut risk tool.

Crop			Production	Index	Low	Med	High
Planting Date Plants per 1m of Row Seed Inoculant Variety Field Calcipril Application Crop Rotation Fertilizer Soil Fertility Soil pH	Apr 15 10 plants (10 cm spacing, Yes Otuhia (Vir-LSR,GRDR) Yes Maize : Maize : Groundnut 150 kg/ha (Yara Legume) High 5.6	CROP\VARIETY Chinese (Span) Konkoma (Span) Obolo (Span-LSR) Oboshie (Span-LSR) Otuhia (Vir-LSR,GRDR) Yenyawoso (Span-GRDR)	Aflatoxin Yield Reduction Red Dots - Change practices Yellow Dots - Consider adjus Green Dots - Risk is acceptal Estim	205 90 to eliminate. ting practices to rn oble for selected pri- ated Cost (¢/h	educe risk. actices. a): 5350		
Tillage Plough and harrow (Improved)			0 1,318	2,636 3,95	4 5	.272	6,590
Digging Timimg Drying Pest Management	Optimum Cemented floor			Create Production	Log		
Aphid Spray	Yes						
Bird Protection	Yes						
Fungicides	2 Sprays						
Rodent Protection	Yes						
Weed Control	Pre herbicides followed by	1 hand weeding					
Storage							
Groundnut Moisture	Less than 10%						
Method	Sealed						
Temperature	Lower than 28 °C						

Fig. 4. Drop down menu for varieties in major season in the southern Ghana peanut risk tool.

presented for individual disciplines (e.g., entomology, plant pathology, nematology, and weed science). In some instances practitioners are required to search through resources to determine interaction across pest disciplines in order to develop a holistic approach to pest management. Several approaches have been developed to address this challenge. In the southeastern region of the US, the Peanut Rx guide allows growers and their advisors to determine the impact of production and pest management practices on tomato spotted wilt (tospovirus, Bunyaviridae) transmitted by thrips (*Frankliniella fusca* Pergande, *F. occidentalis* Hinds) and other pathogens in peanut (Anonymous 2022). In North Carolina in the United States, a Microsoft Excel platform was developed to assess overall risk from production and pest management practices for thirteen pests or groups of pests commonly found in peanut (Jordan et al. 2022). Outside of these educational resources, there are no electronic resources in other countries for peanut that allow the research and education community and practitioners to easily assess the composite risk based on strategies that are planned for a particular field and cropping cycle across several disciplines. An electronic tool that enables farmers and their advisors to assess overall risk with different practices in a more effective manner could potentially result in greater protection of yield and increased financial sustainability.

In NC, a Microsoft Excel platform was designed to allow farmers and their advisors (e.g., private crop consultants, extension agents, agribusiness, nongovernmental organizations, and Federal and State agencies) to identify risk from a set of practices based on field history (Jordan et al. 2022). The platform computes cost of each set of practices so that farmers can observe the financial impact of changes in practices designed to reduce risk. A data log function is also a part

Crop				Production		Index	Low	Med	High
Planting Date Plants per 1m of Row Seed Inoculant Variety Field Crop Rotation Fertilizer	Nov 15 10 plants (10 cm spacing, No Spanish Groundnut : Groundnut : G None	CROP\VARIETY (* Spanish (* Spanish (GRDR) (* Spanish (GRDR,LSR) (* Spanish (LSR) (* Virginia Type (* Virginia Type	×	Aflatoxin Yield Red Dots - C Yellow Dots Green Dots	Change practi - Consider ac - Risk is accep	310 275 ces to eliminate. ljusting practices to r ptable for selected pr	educe risk.		High
Gypsum at Bloom Soil Fertility Soil pH Tillage	Yes High 5.6 Hand dug and ridging	Virginia Type (GRDR) Virginia Type (GRDR,LSR Virginia Type (LSR)	2)	0	Estima 141,922	ated Cost (MK/h 283,844 425;	a): 479,76	7,688	709,610
Digging Timimg Drying Method	Vest Vest Vest Vest Vest Vest Vest Vest				Estimate	ed Person Hours	(hrs/ha):	308	
Aphid Spray Bird Protection Fungicides Rodent Protection Weed Control	Yes Yes 2 Sprays Yes 2 hand weedings during s	eason		0	54	107 16 Create Production	1 2 Log	14	268
Storage Groundnut Moisture Method Temperature	Less than 10% Sealed Lower than 28 °C								

Fig. 5. Drop down menu for varieties in the Malawi peanut risk tool.

Crop		Production	Index	Low	Med	Hi	
Planting Date	Jun 15	Aflatoxin	1085				
Plants per 1m of Row	4 plants (25 cm spacing)	Yield Reduction	905				
Seed Inoculant	No						
Variety	Chinese (Span)	Red Dots - Change practices	to eliminate.				
Field		Yellow Dots - Consider adjus	ting practices to re	educe risk.			
Calciprill Application	No	Green Dots - Risk is acceptal	ble for selected pro	actices.			
Crop Rotation	Groundnut : Groundnut : Groundnut						
Fertilizer	None	Estimated Cost (¢/ha): 818					
Soil Fertility	Low					_	
Soil pH	5.5						
Tillage	Flat Beds (Conventional)						
Harvest		0 919	1,838 2,75	3,6	76	4,595	
Digging Timimg	14 Days Late						
Drying	Ground	(Create Production	Log			
Pest Management							
Aphid Spray	No						
Bird Protection	No						
Fungicides	None						
Rodent Protection	No						
Weed Control	1 hand weeding during season						
Storage							
Groundnut Moisture	10 to 15%						
Method	Traditional						
Temperature	28 to 32 °C						

Fig. 6. Risk to aflatoxin contamination, yield, and cost of production for the limited input system in the northern Ghana peanut risk tool.

Crop		Production	Index	Low	Med	High	
Planting Date	May 15	Aflatoxin	235				
Plants per 1m of Row	10 plants (10 cm spacing, optimum)	Yield Reduction	110				
Seed Inoculant	Yes						
Variety	Sarinut 1 (Vir-LSR,GRDR)	Red Dots - Change practice	s to eliminate.				
Field		Yellow Dots - Consider adju	usting practices to r	educe risk.			
Calciprill Application	Yes	Green Dots - Risk is accept	able for selected pr	actices.			
Crop Rotation	Maize : Maize : Groundnut						
Fertilizer	150 kg/ha (Yara Legume)	Estin	nated Cost (¢/ł	a): 3608			
Soil Fertility	Moderate		(1)			_	
Soil pH	6.0						
Tillage	Plough and harrow (Improved)						
Harvest		0 919	1,838 2,7	57 3,67	6	4,595	
Digging Timimg	Optimum						
Drying	Tarpulin		Create Production	Log			
Pest Management							
Aphid Spray	Yes						
Bird Protection	Yes						
Fungicides	2 Sprays						
Rodent Protection	Yes						
Weed Control	3 hand weedings during season						
Storage							
Groundnut Moisture	Less than 10%						
Method	Sealed						
Temperature	Lower than 28 °C						

Fig. 7. Risk to aflatoxin contamination, yield, and cost of production for the high input system in the northern Ghana peanut risk tool.

Crop		Production	Index	Low	Med	Hig			
Planting Date	May 15	Aflatoxin	570						
Plants per 1m of Row	7 plants (15 cm spacing)	Yield Reduction	480						
Seed Inoculant	No								
Variety	Chinese (Span)	Red Dots - Change practices to	o eliminate.						
Field		Yellow Dots - Consider adjusti	Yellow Dots - Consider adjusting practices to reduce risk.						
Calciprill Application	No	Green Dots - Risk is acceptable	Green Dots - Risk is acceptable for selected practices.						
Crop Rotation	Maize : Maize : Groundnut								
Fertilizer	50 kg/ha (Yara Legume)	Estimat	Estimated Cost (¢/ha): 1418						
Soil Fertility	Moderate					_			
Soil pH	6.0								
Tillage	Flat Beds (Conventional)								
Harvest		0 919 1	1,838 2,75	3,0	76 4	1,595			
Digging Timimg	Optimum								
Drying	Tarpulin	Cr	eate Production	Log					
Pest Management									
Aphid Spray	Yes								
Bird Protection	No								
Fungicides	None								
Rodent Protection	Yes								
Weed Control	2 hand weedings during season								
Storage									
Groundnut Moisture	Less than 10%								
Method	Traditional								
Temperature	Lower than 28 °C								

Fig. 8. Risk to aflatoxin contamination, yield, and cost of production for the medium input system in the northern Ghana peanut risk tool.

Crop		Production	Index	Low	Med Hig			
Planting Date	Nov 15	Aflatoxin	710					
Plants per 1m of Row	7 plants (15 cm spacing)	Yield	450					
Seed Inoculant	No							
Variety	Spanish	Red Dots - Change pra	ctices to eliminate.					
Field		Yellow Dots - Consider	adjusting practices to r	educe risk.				
Crop Rotation	Maize : Maize : Groundnut	Green Dots - Risk is ac	ceptable for selected pr	actices.				
Fertilizer	None							
Gypsum at Bloom	No	Esti	Estimated Cost (MK/ha): 260.400					
Soil Fertility	Low							
Soil pH	5.6							
Tillage	Hand dug and ridging							
Harvest		0 141,922	283,844 425,	766 567,688	709,610			
Digging Timimg	Optimum							
Drying	Ground	Estima	ated Person Hours	(hrs/ha): 222				
Method	Hand dug with hoe							
Pest Management								
Aphid Spray	No	0 54	107 16	1 214	268			
Bird Protection	No							
Fungicides	None							
Rodent Protection	No		Create Production Log					
Weed Control	2 hand weedings during season							
Storage								
Groundnut Moisture	10 to 15%							
Method	Traditional							
Temperature	Higher than 32 °C							

Fig. 9. Risk to aflatoxin contamination, yield, and cost of production for the limited input system in the Malawi peanut risk tool.

Crop		Production	Index	Low	Med	High				
Planting Date	Nov 15	Aflatoxin	400							
Plants per 1m of Row	10 plants (10 cm spacing, optimum)	Yield	200							
Seed Inoculant	No									
Variety	Spanish (GRDR)	Red Dots - Change practic	es to eliminate.							
Field		Yellow Dots - Consider adj	Yellow Dots - Consider adjusting practices to reduce risk.							
Crop Rotation	Maize : Maize : Groundnut	Green Dots - Risk is acceptable for selected practices.								
Fertilizer	150 kg/ha (Yara Legume)									
Gypsum at Bloom	Yes	Estima	Estimated Cost (MK/ha): 463.660							
Soil Fertility	Low			.,,	-	_				
Soil pH	5.6									
Tillage	Hand dug and ridging									
Harvest		0 141,922	283,844 425,7	766 567	,688	709,610				
Digging Timimg	Optimum									
Drying	Tarpulin	Estimate	Estimated Person Hours (hrs/ha): 283							
Method	Hand dug with hoe			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,						
Pest Management										
Aphid Spray	No	0 54	107 161	1 2	14	268				
Bird Protection	Yes									
Fungicides	None									
Rodent Protection	Yes		Create Production	Log						
Weed Control	2 hand weedings during season									
Storage										
Groundnut Moisture	Less than 10%									
Method	Traditional									
Temperature	28 to 32 °C									

Fig. 10. Risk to aflatoxin contamination, yield, and cost of production for the high input system in the Malawi peanut risk tool.

Crop		Production	Index	Low	Med	High			
Planting Date	Nov 15	Aflatoxin	810						
Plants per 1m of Row	7 plants (15 cm spacing)	Yield	460						
Seed Inoculant	No								
Variety	Spanish	Red Dots - Change practic	es to eliminate.						
Field		Yellow Dots - Consider ad	justing practices to re	educe risk.					
Crop Rotation	Maize : Maize : Groundnut	Green Dots - Risk is accep	table for selected pra	actices.					
Fertilizer	None								
Gypsum at Bloom	No	Estima	Estimated Cost (MK/ha): 260.400						
Soil Fertility	Low					_			
Soil pH	5.6								
Tillage	Hand dug and ridging								
Harvest		0 141,922	283,844 425,7	766 567,68	8	709,610			
Digging Timimg	14 Days Late								
Drying	Ground	Estimate	ed Person Hours	(hrs/ha): 22	2				
Method	Hand dug with hoe			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					
Pest Management									
Aphid Spray	No	0 54	107 16	1 214		268			
Bird Protection	No								
Fungicides	None								
Rodent Protection	No		Create Production	Log					
Weed Control	2 hand weedings during season								
Storage									
Groundnut Moisture	Greater than 15%								
Method	Traditional								
Temperature	Higher than 32 °C								

Fig. 11. Influence of timing of digging, drying method, and approaches to storage on aflatoxin contamination, yield, and cost of production in Malawi peanut risk tool with poor practices.

Crop		Production	Index	Low	Med	High			
Planting Date	Nov 15	Aflatoxin	385						
Plants per 1m of Row	7 plants (15 cm spacing)	Yield	Yield 450 • • • • • • • •						
Seed Inoculant	No								
Variety	Spanish	Red Dots - Change practic	es to eliminate.						
Field		Yellow Dots - Consider adj	Yellow Dots - Consider adjusting practices to reduce risk.						
Crop Rotation	Maize : Maize : Groundnut	Green Dots - Risk is accept	table for selected pra	actices.					
Fertilizer	None								
Gypsum at Bloom	No	Estima	Estimated Cost (MK/ha): 328,930						
Soil Fertility	Low			.,		_			
Soil pH	5.6								
Tillage	Hand dug and ridging								
Harvest		0 141,922	283,844 425,7	66 567,6	88 7	09,610			
Digging Timimg	Optimum								
Drying	Cemented floor	Estimate	ed Person Hours	(hrs/ha): 2	26				
Method	Hand dug with hoe				"	_			
Pest Management				///////////////////////////////////////	2				
Aphid Spray	No	0 54	107 161	214		268			
Bird Protection	No								
Fungicides	None								
Rodent Protection	No		Create Production	Log					
Weed Control	2 hand weedings during season								
Storage									
Groundnut Moisture	Less than 10%								
Method	Sealed								
Temperature	Lower than 28 °C								

Fig. 12. Influence of timing of digging, drying method, and approaches storage on aflatoxin contamination, yield, and cost of production in Malawi peanut risk tool with improved practices.

of the platform that enables the user to electronically record production and pest management practices for the field and other important factors including yield, market grade characteristics, and rainfall. A detailed description of the NC peanut risk tool and examples of pests and pest management interactions are provided elsewhere (Jordan et al. 2022). When the NC peanut risk tool was under development, the decision to use Microsoft Excel as the platform was made so that tools for other states in the US or other countries could use the platform to create their own risk management tool. A portion of the funding for the development of the NC peanut risk tool was from the USAID Feed the Future Innovation Lab for Peanut with a specific goal of creating a tool that was transferable to partnering countries and ultimately a risk management tool that is available for the general public. In this paper, we provide examples of Microsoft Excel based peanut risk tools developed for Argentina, Ghana, India, and Malawi using the peanut risk tool initially developed for NC. The current iteration of each of these tools, a blank template, and an instructional video for creation of a risk tool can be found at: https://cropmanagement.cals.ncsu.edu/risk-tools/peanut.html.

Peanut Risk Tools in Ghana and Malawi

The peanut risk tools for Ghana and Malawi were developed simultaneously with information from both countries exchanged among scientists and practitioners. Risk to yield and contamination by aflatoxin (produced by *Aspergillus flavus* and *A. parasiticus*)

Crop				Disease (Foliar)	Index	Low	Med	High		
Cultivar	GG 20			Alternaria Leaf Spot	118					
Planting Date	Jun 25		_	Early Leaf spot - Rainfed	118					
Plants per 1m Row	6 or fewer	CROP\CULTIVAR >	C	Early Leaf Spot - Summer	118					
Row Pattern	Single (75 - 1	C BG 3		Late Leaf Spot - Rainfed	118					
Field		C CSMG 84-1		Late Leaf Spot - Summer	118					
Intercrop	None	C GG 2		PBND	136					
Irrigation	Irrigated	@ GG 20		Rust	123					
Soil pH	7.0	C GG 7		Disease (Stem)	Index	Low	Med	High		
Tillage	Conventional	C ICG FDRS 10		Aflaroot	106					
Field Crop Rotation		C ICGS 44		Collar Rot	106					
1 Crop Season Ago	Groundnut	C ICGS 76		Stem Rot	126					
2 Crop Seasons Ago	Groundnut	C ICGV 86590		Insect	Index	Low	Med	High		
3 Crop Seasons Ago	Groundnut	C M 335		Defoliaters	136					
4 Crop Seasons Ago	Groundnut	C M 522		Sucking Pests	136					
Field Nematode Population		C R 8808		Nematode	Index	Low	Med	High		
Root Knot	High	C R 9201		Root Knot	80					
Root Lesion	High	C Somnath		Root-Lesion	80					
Stunt	High	C TG 37 A		Stunt-Kalahasty Malady	80					
Field Pest History		C TPG-41		Soil	Index	Low	Med	High		
Aflaroot	Problem even		trol program	Pests	131					
Alternaria Leaf Spot	Problem even		n							
Collar Rot	Problem even	with good fungicide/bioc	ontrol program	Red Dots - Change practices to e	liminate.					
Defoliators	Problem even	with good pesticide prog	ram	Yellow Dots - Consider adjusting	practices to re	educe risk.				
Early Leaf Spot Rainfed	Problem even	with good fungicide prog	Iram	Green Dots - Risk is acceptable f	or selected pra	actices.				
Early Leaf Spot Summer	Problem even	with good fungicide prog	Iram							
Late Leaf Spot Rainfed	Problem even	with good fungicide prog	Iram	Cr:	ate Productio	nlog				
Late Leaf Spot Summer	Problem even	with good fungicide prog	Iram	ci	create Production Log					
PBND	Problem even	with good fungicide prog	Iram							
Rust	Problem even	with good fungicide prog	Iram							
Soil Pests	Problem even	with good pesticide prog	ram							
Stem Rot	Problem even	with good fungicide/bioc	ontrol program							
Sucking Pests	Problem even	with good pesticide prog	ram							
Natural Pest Enemy Population	n									
Defoliators	Low/Below Av	erage								
Sucking Pests	Low/Below Av	erage								
Pest Control										
Nematicide	None									

Fig. 13. Drop down menu for varieties in India peanut risk tool.

were compared using information for five categories of practices. Examples of the components of the northern Ghana peanut risk tool are presented in Figs. 1 and 2. The risk tools differed between the countries primarily in areas of cultivar selection, planting patterns and plant population, and planting dates. Also, peanut production in Ghana is impacted by a bimodal rainfall pattern in southern Ghana and a unimodal rainfall pattern in northern Ghana. Malawi has a single production season similar to northern Ghana. Risk tools in Ghana and Malawi include estimates of production and pest management costs. The Malawi risk tool also includes estimates of the time required to complete tasks (e.g., labor costs in person hours). Cultivar selection is a major driver of yield and is an important element of risk tools in Ghana and Malawi. Drop down menus for cultivar selection for both risk tools in Ghana (unimodal and bimodal rainfall seasons) and the risk tool in Malawi are presented in Figs. 3-5.

Risk to yield and aflatoxin contamination for three levels of input for northern Ghana are contrasted in Figs. 6–8. When inputs are limited, risk to both yield and aflatoxin are high as noted with three dots in the red category for both parameters (Fig. 6). This approach to peanut production in many areas of Ghana is not uncommon where availability of interventions are limited and financial constraints exist (e.g., financial credit and access to loans) (Abudulai et al. 2020, Appaw et al. 2020). Estimated cost of production for this low input system was \$131/ha (818 Ghana cedes/ha). When resources are available and interventions are included across all categories, risk to yield and contamination by aflatoxin was essentially eliminated but at a cost that is over four times the cost of the low input system (\$577/ha or 3,608 Ghana cedes/ha) (Fig. 7). Few peanut farmers in Ghana have access to all interventions and/or financing to purchase available resources prior to the cropping cycle. A reasonable alternative to both the low and high input systems is presented in Fig. 8. Risk in this scenario remains relatively high (e.g., yellow dots for yield and aflatoxin) but with lower costs at \$226/ha (1,418 Ghana cedes/ha). Although cost is greater than the low input system, risk to yield and aflatoxin is lowered considerably compared with the low input system.

The Malawi peanut risk tool allows practitioners to observe not only changes in cost of production as risk is addressed but also gives an estimate of the labor involved as practices are modified. For example, cost of production when inputs are limited is \$322/ha (260,400 Malawian kwacha/ha) with 222 person hours required in the limited input system (Fig. 9). In contrast, risk was lowered with increased inputs (e.g., fertilizer, gypsum, fungicide, and additional hand weeding) but required an increase to 283 person h/ha and a cost of \$574/ha (463,660 Malawian kwacha/ha) (Fig. 10). The Malawi risk tool also demonstrates the value of adopting improved practices associated with digging peanut, drying, and storage to mitigate aflatoxin contamination (Figs. 11 and 12). Two red dots were present when peanut was dug 14 d after optimum pod maturity, dried on the ground to moisture exceeding 15%, and stored in a traditional setting at temperatures exceeding 32°C (Fig. 11). Risk was reduced to only one yellow dot when peanut was dug at optimum maturity, dried on cement flooring to less than 10% moisture, and stored in sealed bags at 28°C or lower (Fig. 12). Although not captured in this version of the Malawi risk tool, previous research (Appaw et al. 2020) reported that drying on tarps and storing in hermeticallysealed bags prevented increases in aflatoxin contamination during storage compared with traditional practices (e.g., drying on soil and storing in non-sealed bags) and also resulted in more higher quality

LC	OW MO	DDERATE	HIGH		
///////	//////////////////////////////////////	///////////////////////////////////////		123	
43	60	85		133	
Crop\Cultiva	r			Risk	k Points
GG 20*				30)
BG 3, CSN	1G 84-1, GG 2, GG 7, ICG	65 44, ICGS 76, M 335, M	522, Somnath	20	30
ICG FDRS	10, ICGV 86590, R 8808,	R 9201, TG 37 A, TPG-41	L	10)
Crop\Plantin	g Date			Risk	k Points
Jun 20 to	Dec 31*			10) 10
Jan 01 to .	Jun 19			5	; 10
Field\Intercro	ор			Risk	k Points
Cluster Be	an, Cotton, Maize, Pear	I Millet, Pulses, Sorghum		15	; E
None*				5	; 3
Field\Irrigation	on			Risk	k Points
Irrigated (Recommended), Irrigate	ed*		15	j 15
Non-Irriga	ated			5	; 15
Field\Tillage				Risk	k Points
Conventio	onal*, Deep (Improved)			15	j 15
Strip into	killed cover crop or prev	vious crop residue		5	; 15
Field Crop Ro	otation \1 Crop Season A	Ago		Risk	k Points
Groundnu	it*			15	1E
Chickpea,	Cotton, Cumin, Fodder,	Garlic, Melons, Onion, P	earl Millet, Vegetables, Wheat	3	3 15
Field Crop Ro	otation\2 Crop Seasons	Ago		Risk	k Points
Groundnu	ıt*			10) 10
Chickpea,	Cotton, Cumin, Fodder,	Garlic, Melons, Onion, P	earl Millet, Vegetables, Wheat	2	2 10
Field Crop Ro	otation\3 Crop Seasons	Ago		Risk	k Points
Groundnu	ıt*			5	5 5
Chickpea,	Cotton, Cumin, Fodder,	Garlic, Melons, Onion, P	earl Millet, Vegetables, Wheat	2	2 3
Field Crop Ro	otation\4 Crop Seasons	Ago		Risk	k Points
Groundnu	it*			3	3 2
Chickpea,	Cotton, Cumin, Fodder,	Garlic, Melons, Onion, P	earl Millet, Vegetables, Wheat	1	. 3
Field Pest His	story\Rust			Risk	k Points
Problem e	even with good fungicide	e program*		15	\$
Present b	ut not a problem with g	ood fungicide program		10) 15
None (Gro	oundnut never grown)			5	\$
* Selected or	otions used in calculatin	g pest risk.			

Groundnut - Rust Risk Summary

Note: Reduction in pest risk value by a control practice will be less under low risk conditions.

Fig. 14. Risk summary for rust in the India peanut risk tool.

kernels for the market. Less time and labor would be needed by the farmer because quality of peanut is at a higher level due to improved harvest, drying, and storage.

Argentina, India, and the United States

In contrast to Ghana and Malawi, farmers in Argentina, India, and NC (USA) have greater resources and inputs at their disposal to manage pests. While discussed in detail elsewhere, the NC risk tool includes individual risk indices for 13 pests or groups of pests and a wide range of pesticides available to suppress pest populations (Jordan et al. 2022). At the current time, risk tools for Argentina and India do not have cost of inputs. Improved cultivars are widely available for adoption as they are released because of a reliable certified seed delivery system. With the exception of tomato spotted wilt, a significant number of pesticides is available to suppress all pests that are economically important for peanut. However, cultural practices also contribute to suppression of pests.

The India peanut risk tool includes 16 pests or groups of pests under five categories (Fig. 13). A drop down menu for cultivars is presented in Fig. 13. Practices that affect rust (*Puccinia arachidis* Speg.) in peanut are presented in Fig. 14. When peanut was grown continuously and intercropped with corn (*Zea mays* L.) with limited inputs, risk was high (e.g., numerous red dots) for all pests (Fig. 15). In contrast, establishing a more effective rotation sequence with two cycles of cotton (*Gossypium hirsutum* L.), not intercropping, and planting a cultivar with resistance to this pathogen decreased risk substantially (Fig. 16). The current India peanut risk tool does not include the cost associated with production and pest management practices.

Crop		
Cultivar	BG 3	
Planting Date	Jun 25	
Plants per 1m Row	6 or fewer	
Row Pattern	Single (75 - 100 cm)	
Field		
Intercrop	Maize	
Irrigation	Non-Irrigated	
Soil pH	6.3	
Tillage	Conventional	
Field Crop Rotation		
1 Crop Season Ago	Groundnut	
2 Crop Seasons Ago	Groundnut	
3 Crop Seasons Ago	Groundnut	
4 Crop Seasons Ago	Groundnut	
Field Nematode Population		
Root Knot	High	
Root Lesion	High	
Stunt	High	
Field Pest History		
Aflaroot	Problem even with good fungicide/biocontrol program	
Alternaria Leaf Spot	Problem even with good fungicide program	
Collar Rot	Problem even with good fungicide/biocontrol program	
Defoliators	Problem even with good pesticide program	
Early Leaf Spot Rainfed	Problem even with good fungicide program	
Early Leaf Spot Summer	Problem even with good fungicide program	
Late Leaf Spot Rainfed	Problem even with good fungicide program	
Late Leaf Spot Summer	Problem even with good fungicide program	
PBND	Problem even with good fungicide program	
Rust	Problem even with good fungicide program	
Soil Pests	Problem even with good pesticide program	
Stem Rot	Problem even with good fungicide/biocontrol program	
Sucking Pests	Problem even with good pesticide program	
Natural Pest Enemy Popula	ation	
Defoliators	Low/Below Average	
Sucking Pests	Low/Below Average	
Pest Control		
Nematicide	None	

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	•,		•

Disease (Foliar)	Index	Low	Med	High
Alternaria Leaf Spot	98			
Early Leaf spot - Rainfed	98			
Early Leaf Spot - Summer	98			
Late Leaf Spot - Rainfed	98			
Late Leaf Spot - Summer	98			
PBND	136			
Rust	113			
Disease (Stem)	Index	Low	Med	High
Aflaroot	101			
Collar Rot	101			
Stem Rot	121			
Insect	Index	Low	Med	High
Defoliaters	121			•
Sucking Pests	121			•
Nematode	Index	Low	Med	High
Root Knot	80			
Root-Lesion	80			
Stunt-Kalahasty Malady	80			
Soil	Index	Low	Med	High
Pests	116			

Red Dots - Change practices to eliminate. Yellow Dots - Consider adjusting practices to reduce risk.

Green Dots - Risk is acceptable for selected practices.

Create Production Log

Fig. 15. Risk from pests in the India peanut risk tool with limited inputs and practices.

Crop		Dise
Cultivar	ICG FDRS 10	A
Planting Date	May 15	Ea
Plants per 1m Row	13 or more	Ea
Row Pattern	Twin (15 - 25 cm)	La
Field		La
Intercrop	None	PI
Irrigation	Irrigated (Recommended)	R
Soil pH	7.0	Dise
Tillage	Conventional	A
Field Crop Rotation		C
1 Crop Season Ago	Cotton	St
2 Crop Seasons Ago	Cotton	Inse
3 Crop Seasons Ago	Groundnut	D
4 Crop Seasons Ago	Groundnut	Su
Field Nematode Population		Nem
Root Knot	High	R
Root Lesion	High	R
Stunt	High	St
Field Pest History		Soil
Aflaroot	Present but not a problem with good fungicide/biocontrol program	Pe
Alternaria Leaf Spot	Present but not a problem with good fungicide program	
Collar Rot	Present but not a problem with good fungicide/biocontrol program	Red
Defoliators	Present but not a problem with good pesticide program	Yello
Early Leaf Spot Rainfed	Present but not a problem with good fungicide program	Gree
Early Leaf Spot Summer	Present but not a problem with good fungicide program	
Late Leaf Spot Rainfed	Present but not a problem with good fungicide program	
Late Leaf Spot Summer	Present but not a problem with good fungicide program	
PBND	Present but not a problem with good fungicide program	
Rust	Present but not a problem with good fungicide program	
Soil Pests	Present but not a problem with good pesticide program	
Stem Rot	Present but not a problem with good fungicide/biocontrol program	
Sucking Pests	Present but not a problem with good pesticide program	
Natural Pest Enemy Popula	ition	
Defoliators	Low/Below Average	
Sucking Pests	Low/Below Average	
Pest Control		
Nematicide	Metam Sodium	

Disease (Foliar)	Index	Low	Med	High
Alternaria Leaf Spot	73			
Early Leaf spot - Rainfed	68			
Early Leaf Spot - Summer	73			
Late Leaf Spot - Rainfed	68			
Late Leaf Spot - Summer	73			
PBND	68			
Rust	73			
Disease (Stem)	Index	Low	Med	High
Aflaroot	68		•	
Collar Rot	68		•	
Stem Rot	83			
Insect	Index	Low	Med	High
Defoliaters	98		••	
Sucking Pests	98		••	
Nematode	Index	Low	Med	High
Root Knot	35			
Root-Lesion	35			
Stunt-Kalahasty Malady	35			
Soil	Index	Low	Med	High
Paete	88			

Red Dots - Change practices to eliminate. /ellow Dots - Consider adjusting practices to reduce risk. Green Dots - Risk is acceptable for selected practices.

Create Production Log

Crop Practices					
Cultivar	Granoleico				
Plant Pattern	> 10 plts/m (7	CROP PRACTICES\CULTIVAR	×		
Field		C ASEM 400			
Soil Smut Inoculum	1500 or greate	C EC-191 RC			
Tillage System	Reduced Tilla	C EC-214			
Weeds and Herbicide Resistance	Palmer A. (AL	C EC-98			
Field Crop History		Granoleico			
Crop 1 Season Ago	Soybean	C MA-02			
Crop 2 Seasons Ago	Soybean	C MA-757			
Crop 3 Seasons Ago	Soybean	C MA-88			
Leaf Spot Management					
Chlorothalonil Applications	3 Sprays				
Fungicide Resistance	Groups 3+7+1	1+M			
Spray Schedule	Calendar				
Pest History					
Leaf Spot	Problem with g	good fungicide program			
Sclerotoina Blight	Present				
Smut	Problem with g	good fungicide program			
Treatments					
Iridium Applictions	None				
Miticides	Abamectin				
Weed Mgmt	PRE + EPOS	T + MPOST			
Weather Pattern					
Period 1 Sept and Oct	Moist				
Period 2 Nov and Dec	Moist				
Period 3 Jan and Feb	Moist				
Period 4 Mar and Apr	Moist				

Arthropod	Index	Low	Med	High
Spider Mites	73		•	
Disease (Foliar)	Index	Low	Med	High
Leaf Spot	286			•
Disease (Soil Borne)	Index	Low	Med	High
Sclerotinia Blight	243			
Smut	300			
Plant	Index	Low	Med	High
Weeds	75			

Red Dots - Change practices to eliminate.

Yellow Dots - Consider adjusting practices to reduce risk Green Dots - Risk is acceptable for selected practices.

Create Production Log

Fig. 17. Drop down menu for varieties in the Argentina peanut risk tool.

Crop Practices		Arthropod	Index	Low	Med	High
Cultivar	Granoleico	Spider Mites	73		•	
Plant Pattern	> 10 plts/m (70 cm single row)	Disease (Foliar)	Index	Low	Med	High
Field		Leaf Spot	306			•
Soil Smut Inoculum	1500 or greater spores/g soil	Disease (Soil Borne)	Index	Low	Med	High
Tillage System	Reduced Tillage	Sclerotinia Blight	229			
Weeds and Herbicide Resistance	Palmer A. (ALS resistant)	Smut	300			
Field Crop History		Plant	Index	Low	Med	High
Crop 1 Season Ago	Corn	Weeds	75			
Crop 2 Seasons Ago	Peanut					
Crop 3 Seasons Ago	Corn	Red Dots - Change practices to	o eliminate.			
Leaf Spot Management		Yellow Dots - Consider adjusti	ng practices to re	educe risk.		
Chlorothalonil Applications	3 Sprays	Green Dots - Risk is acceptabl	e for selected pra	actices.		
Fungicide Resistance	Groups 3+7+11+M					
Spray Schedule	Calendar		Create Broductic	nlog		
Pest History			create Froductic	in Log		
Leaf Spot	Problem with good fungicide program					
Sclerotoina Blight	Present					
Smut	Problem with good fungicide program					
Treatments						
Iridium Applictions	None					
Miticides	Abamectin					
Weed Mgmt	PRE + EPOST + MPOST					
Weather Pattern						
Period 1 Sept and Oct	Moist					
Period 2 Nov and Dec	Moist					
Period 3 Jan and Feb	Moist					
Period 4 Mar and Apr	Moist					

Fig. 18. High risk of smut disease in the Argentina peanut risk tool with short rotations and planting a cultivar without resistance to this disease.

The Argentina peanut risk tool includes indices for two-spotted spider mites (*Tetranychus urticae* Koch), peanut smut disease (caused by *Thecaphora frezii* Carranza and Lindquist), early leaf spot disease [caused by *Mycosphaerella arachidicola* W.A. Jenkins (*syn. Passalora arachidicola* W.A. Jenkins], late leaf spot disease [caused by *Nothopassalora personata* (Berk. & M.A. Curtis) U. Braun, C. Nakash., Videira & Crous], Sclerotinia blight (*Sclerotinia minor* Jagger), and weeds (Fig. 17). Eight cultivars are listed in the drop down menu for Argentina (Fig. 17). Similar to the India peanut risk tool, the current tool for Argentina does not include a cost comparison for management inputs. Risk to smut disease was high when the cultivar Granoleico was planted and the rotation prior to peanut was corn, peanut, and soybean [*Glycine max* (L.) Merr.] (Fig. 18). Adding one more year of corn prior to peanut and planting the cultivar EC-191 RC eliminated risk of smut disease (Fig. 19).

Similar to the NC peanut risk tool (Jordan et al. 2022), the Argentina peanut risk tool includes a drop down menu for resistance to fungicides with respect to leaf spot disease and herbicides (Figs. 20 and 21). Three scenarios associated with risk to two-spotted spider mites are presented in Figs. 22–24. Applying chlorothalonil (a broad spectrum and nonsystemic fungicide) three times during the season created greater risk for two-spotted spider mites compared with only one application of this fungicide (Fig. 22). Chlorothalonil and other fungicides can decrease presence of beneficial fungal pathogen *Entomophthora fresenii* Nowakowski, that adversely affects two-spotted spider mites in peanut, especially when moisture is limited (Carner and Canerday 1968, Campbell 1978). Chlorothalonil can also increase risk of Sclerotinia blight (Figs. 22 and 23) but is an effective fungicide for resistance management because it is a multi-site fungicides (Culbreath et al. 2002). Abamectin moderated risk to two-spotted mites (Fig. 24).

Crop Practices		Arthropod	Index	Low	Med	High		
Cultivar	ASEM 400	Spider Mites	73	0000	•			
Plant Pattern	> 10 plts/m (70 cm single row)	Disease (Foliar)	Index	Low	Med	High		
Field		Leaf Spot	289			•		
Soil Smut Inoculum	1500 or greater spores/g soil	Disease (Soil Borne)	Index	Low	Med	High		
Tillage System	Reduced Tillage	Sclerotinia Blight	216					
Weeds and Herbicide Resistance	Palmer A. (ALS resistant)	Smut	195					
Field Crop History		Plant	Index	Low	Med	High		
Crop 1 Season Ago	Corn	Weeds	75		••			
Crop 2 Seasons Ago	Corn							
Crop 3 Seasons Ago	Corn	Red Dots - Change practices to	o eliminate.					
Leaf Spot Management		Yellow Dots - Consider adjusti	ng practices to re	educe risk.				
Chlorothalonil Applications	3 Sprays	Green Dots - Risk is acceptable for selected practices.						
Fungicide Resistance	Groups 3+7+11+M							
Spray Schedule	Calendar	Create Desclustion Los						
Pest History			create Productio	ling				
Leaf Spot	Problem with good fungicide program							
Sclerotoina Blight	Present							
Smut	Problem with good fungicide program							
Treatments								
Iridium Applictions	2 Sprays							
Miticides	Abamectin							
Weed Mgmt	PRE + EPOST + MPOST							
Weather Pattern								
Period 1 Sept and Oct	Moist							
Period 2 Nov and Dec	Moist							
Period 3 Jan and Feb	Moist							
Period 4 Mar and Apr	Moist							

Fig. 19. Risk of smut disease in the Argentina peanut risk tool when the number of years between peanut plantings is increased, a smut tolerant variety is planted, and iridium is applied.

Crop Practices				Arthropod	Index	Low	Med	High
Cultivar	MA-02			Spider Mites	73		•	
Plant Pattern	> 10 plts/m (7	LEAF SPOT MANAGEMENT/FUNGICIDE RESISTANCE	×	Disease (Foliar)	Index	Low	Med	High
Field		Group M (Multi-site)		Leaf Spot	246			
Soil Smut Inoculum	1500 or greate	C Groups 3+7		Disease (Soil Borne)	Index	Low	Med	High
Tillage System	Reduced Tilla	C Groups 3+11		Sclerotinia Blight	216			
Weeds and Herbicide Resistance	Palmer A. (AL	C Groups 7+11		Smut	245			•
Field Crop History		Groups 3+7+11		Plant	Index	Low	Med	High
Crop 1 Season Ago	Corn	C Groups 3+7+11+M		Weeds	85			
Crop 2 Seasons Ago	Corn							
Crop 3 Seasons Ago	Corn			Red Dots - Change practices t	o eliminate.			
Leaf Spot Management				Yellow Dots - Consider adjust	ing practices to re	educe risk.		
Chlorothalonil Applications	3 Sprays			Green Dots - Risk is acceptabl	le for selected pra	actices.		
Fungicide Resistance	Groups 3+7+1	1						
Spray Schedule	Calendar			Create Breduction Log				
Pest History					create Productic	in Log		
Leaf Spot	Problem with g	ood fungicide program						
Sclerotoina Blight	Present							
Smut	Problem with g	ood fungicide program						
Treatments								
Iridium Applictions	None							
Miticides	Abamectin							
Weed Mgmt	PRE + EPOST	T + MPOST						
Weather Pattern								
Period 1 Sept and Oct	Moist							
Period 2 Nov and Dec	Moist							
Period 3 Jan and Feb	Moist							
Period 4 Mar and Apr	Moist							

Fig. 20. Drop down menu for fungicide resistance in the Argentina peanut risk tool.

Future Goals for Peanut Risk Tools

The risk tools described for peanut in this article serve as a starting point and are designed for modification as well as expansion to other peanut production areas. In the process of developing these tools several limitations have been identified due to dynamic nature of risk components. First, it is possible that modifications to create tools or portions of tools do not reflect the current knowledge of peanut production systems. Of course, the current versions are not complete in the sense that empirical data sets are a foundation for all of the point designations within and across pest disciplines and individual pests. A considerable amount of the information used in these tools reflects information provided by practitioners that are not verified by experimental data. However, it is important that risk tools created represent the current knowledge base for peanut production and pest management. When tools are modified there also needs to be a reference file that is considered 'official' so that the risk tool is consistent in format and content. With that said, modifications that represent other production areas are a recommended and are a key reason why the initial risk tool was created in Microsoft Excel, especially given the ubiquitous nature of this platform.

A second limitation to the current platform is that it is designed primarily as a planning tool with limited options once the cropping cycle begins. Integrating the tool with other outreach platforms or

Crop Bractices			
Crop Practices			,
Cultivar	MA-02	FIELD\WEEDS AND HERBICIDE RESISTANCE	
Plant Pattern	> 10 plts/m (7	C Assured Crosse	C
Field		Annual Grass	
Soil Smut Inoculum	1500 or greate	Annual Grass (ACC and ALS resistant)	D
Tillage System	Reduced Tilla	C Annual Grass (ACC resistant)	
Weeds and Herbicide Resistance	Palmer A. (AL	C Annual Grass (ALS resistant)	
Field Crop History		C Conyza	P
Crop 1 Season Ago	Corn	 Conyza (Glyphosate resistant) 	
Crop 2 Seasons Ago	Corn	○ Others	
Crop 3 Seasons Ago	Corn	C Palmer A.	R
Leaf Spot Management		Palmer A. (ALS resistant)	Y
Chlorothalonil Applications	3 Sprays	C Pigweed	G
Fungicide Resistance	Groups 3+7+1	O Pigweed (ALS resistant)	
Spray Schedule	Calendar	○ Sedges	
Pest History		C Volunteer Corn	
Leaf Spot	Problem with	C Volunteer Soybean	
Sclerotoina Blight	Present		
Smut	Problem with		
Treatments			
Iridium Applictions	None		
Miticides	Abamectin		
Weed Mgmt	PRE + EPOS	T + MPOST	
Weather Pattern			
Period 1 Sept and Oct	Moist		
Period 2 Nov and Dec	Moist		
Period 3 Jan and Feb	Moist		
Period 4 Mar and Apr	Moist		

Arthropod	Index	Low	Med	High
Spider Mites	73			
Disease (Foliar)	Index	Low	Med	High
Leaf Spot	286			•
Disease (Soil Borne)	Index	Low	Med	High
Sclerotinia Blight	216			
Smut	245			•
Plant	Index	Low	Med	High
Contract of the second s				
Weeds	85	••••		
Weeds Red Dots - Change prac Yellow Dots - Consider Green Dots - Risk is acc	85 tices to eliminate. adjusting practices to re eptable for selected pra	educe risk. actices.		

Fig. 21. Drop down menu for weeds based on herbicides resistance in the Argentina peanut risk tool.

Crop Practices		Arthropod	Index	Low	Med	High
Cultivar	MA-02	Spider Mites	103			•
Plant Pattern	> 10 plts/m (70 cm single row)	Disease (Foliar)	Index	Low	Med	High
Field		Leaf Spot	246			
Soil Smut Inoculum	1500 or greater spores/g soil	Disease (Soil Borne)	Index	Low	Med	High
Tillage System	Reduced Tillage	Sclerotinia Blight	224			
Weeds and Herbicide Resistance	Palmer A. (ALS resistant)	Smut	255			•
Field Crop History		Plant	Index	Low	Med	High
Crop 1 Season Ago	Corn	Weeds	85			
Crop 2 Seasons Ago	Soybean					
Crop 3 Seasons Ago	Corn	Red Dots - Change practice	s to eliminate.			
Leaf Spot Management		Yellow Dots - Consider adju	sting practices to re	educe risk.		
Chlorothalonil Applications	3 Sprays	Green Dots - Risk is accepta	Green Dots - Risk is acceptable for selected practices.			
Fungicide Resistance	Groups 3+7+11					
Spray Schedule	Calendar	Create Production Log				
Pest History			cleate Floudeth	in Log		
Leaf Spot	Problem with good fungicide program					
Sclerotoina Blight	Present					
Smut	Problem with good fungicide program					
Treatments						
Iridium Applictions	None					
Miticides	None					
Weed Mgmt	PRE + EPOST + MPOST					
Weather Pattern						
Period 1 Sept and Oct	Moist					
Period 2 Nov and Dec	Moist					
Period 3 Jan and Feb	Moist					
Period 4 Mar and Apr	Moist					

Fig. 22. Risk of two-spotted spider mite infestation when three applications of chlorothalonil are made to peanut in the Argentina peanut risk tool.

applications on smartphones would create a time sensitive approach that would be an important advance. If used appropriately, the current risk tool platform decreases the likelihood that practitioners will begin the cropping cycle with elevated risk. The risk tool also serves as a historical record of a field or group of fields by using the production log feature. In this sense the risk tool is future looking. However, greater flexibility in the risk tool for decision-making during the cropping cycle is needed.

A third limitation to these risk tools is the economic component. While this element serves the user by allowing observations of changes in risk linked to production and pest management costs, moving this component of the risk tool toward a true financial comparison using empirical and observation data based on net returns rather than a simple cost of pest management would be an improvement. Efforts are currently underway in both Ghana and NC to address this limitation by collecting survey data from farmers using categories listed in the risk tool along with weather data, reported yield for that particular cropping cycle, and yield estimates over a longer period of time.

As with all models and tools, validation is needed with these risk tools. As these risk tools are put into practice, adjustments in distribution of points within categories in context of points in other categories need refinement. None-the-less, these risk tools provide a source of greater information exchange on the complicated nature of pest management in peanut for five countries across four continents.

Crop Practices		Arthropod	Index	Low	Med	High	
Cultivar	MA-02	Spider Mites	83				
Plant Pattern	> 10 plts/m (70 cm single row)	Disease (Foliar)	Index	Low	Med	High	
Field		Leaf Spot	246		••		
Soil Smut Inoculum	1500 or greater spores/g soil	Disease (Soil Borne)	Index	Low	Med	High	
Tillage System	Reduced Tillage	Sclerotinia Blight	214			••	
Weeds and Herbicide Resistan	ce Palmer A. (ALS resistant)	Smut	255			•	
Field Crop History		Plant	Index	Low	Med	High	
Crop 1 Season Ago	Corn	Weeds	Weeds 85				
Crop 2 Seasons Ago	Soybean	Red Dots - Change practices to eliminate.					
Crop 3 Seasons Ago	Corn						
Leaf Spot Management		Yellow Dots - Consider adjusti	ng practices to re	educe risk.			
Chlorothalonil Applications	1 Spray	Green Dots - Risk is acceptable for selected practices.					
Fungicide Resistance	Groups 3+7+11						
Spray Schedule	Calendar	Create Production Log					
Pest History			create Productic	in rog			
Leaf Spot	Problem with good fungicide program						
Sclerotoina Blight	Present						
Smut	Problem with good fungicide program						
Treatments							
Iridium Applictions	None						
Miticides	None						
Weed Mgmt	PRE + EPOST + MPOST						
Weather Pattern							
Period 1 Sept and Oct	Moist						
Period 2 Nov and Dec	Moist						
Period 3 Jan and Feb	Moist						
Period 4 Mar and Apr	Moist						

Fig. 23. Risk of two-spotted spider mite infestation when one application of chlorothalonil is made to peanut in the Argentina peanut risk tool.

Crop Practices		Arthropod	Index	Low	Med	High	
Cultivar	MA-02	Spider Mites	73				
Plant Pattern	> 10 plts/m (70 cm single row)	Disease (Foliar)	Index	Low	Med	High	
Field		Leaf Spot	246				
Soil Smut Inoculum	1500 or greater spores/g soil	Disease (Soil Borne)	Index	Low	Med	High	
Tillage System	Reduced Tillage	Sclerotinia Blight	224				
Weeds and Herbicide Resistant	nce Palmer A. (ALS resistant)	Smut	255			•	
Field Crop History		Plant	Index	Low	Med	High	
Crop 1 Season Ago	Corn	Weeds	85				
Crop 2 Seasons Ago	Soybean						
Crop 3 Seasons Ago	Corn	Red Dots - Change practices to	o eliminate.				
Leaf Spot Management		Yellow Dots - Consider adjusting practices to reduce risk.					
Chlorothalonil Applications	3 Sprays	Green Dots - Risk is acceptable for selected practices.		actices.			
Fungicide Resistance	Groups 3+7+11						
Spray Schedule	Calendar	Create Production Log					
Pest History			create Froudette	Log			
Leaf Spot	Problem with good fungicide program						
Sclerotoina Blight	Present						
Smut	Problem with good fungicide program						
Treatments							
Iridium Applictions	None						
Miticides	Abamectin						
Weed Mgmt	PRE + EPOST + MPOST						
Weather Pattern							
Period 1 Sept and Oct	Moist						
Period 2 Nov and Dec	Moist						
Period 3 Jan and Feb	Moist						
Period 4 Mar and Apr	Moist						

Fig. 24. Risk of two-spotted spider mite infestation when three applications of chlorothalonil are made and abamectin is applied in the Argentina peanut risk tool.

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