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RESEARCH NOTE

Peanut Yield and Grade Response to Glyphosate Plus Dicamba

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ABSTRACT

Due to the increased adoption of dicamba-tolerant cotton (*Gossypium hirsutum* L.) and soybean [*Glycine max* (L.) Merr.], near-by sensitive broadleaf crops such as peanut (*Arachis hypogaea* L.) are at an increased risk for off-target movement events. Limited data on peanut response to multiple exposure events of reduced rates of glyphosate plus dicamba are available. Therefore, the objective of this study was to determine the impact of multiple exposure events and low rates of glyphosate plus dicamba on peanut yield and grade across multiple locations in the southeast and southwest production regions of the U.S. In 2019/2020, field trials were conducted in seven states (AL, FL, GA, NC, OK, SC, TX). Glyphosate plus dicamba timings were 30 + 60 days after planting (DAP) or 30 + 60 + 90 DAP. Glyphosate plus dicamba rates were 12.6 g ae/ha + 5.6 g ae/ha (1/100X) and 25.2 g ae/ha + 11.2 g ae/ha (1/50X). In the southeast region (AL, FL, GA, NC, SC), peanut yield was not reduced by the 1/100X rate but was reduced 9% by 1/50X rate. Peanut yield was not reduced by any rate or timing in the southwest region (OK, TX). In OK and TX (South), total sound mature kernels were reduced 1% to 4% by the 1/50X rate of glyphosate plus dicamba or when glyphosate plus dicamba was applied 30 + 60 + 90 DAP. Increases in peanut pod malformations (4% to 11%) were observed in GA and NC but this response was not consistent. Multiple off-target exposure events of glyphosate plus dicamba at rates ≤ 1/100X in peanut should not result in significant yield or grade losses but may cause abnormal pod development.

INTRODUCTION

In 2023, cotton (*Gossypium hirsutum* L.) and peanut (*Arachis hypogaea* L.) were harvested on approximately 2.86 and 0.64 million hectares in the U.S. (USDA-NASS, 2024). These two uniquely different crops share common ground, as cotton is considered to be an acceptable crop to include in rotation with peanut to reduce soil pathogens and nematodes (Johnson *et al.*, 1998). But, the differing weed management strategies for these two crops make management implications inherently difficult when they are produced within very close proximity (Johnson III *et al.*, 2001; Johnson *et al.*, 2012).

The rapid adoption of herbicide-tolerant technology in crops such as cotton and soybean [*Glycine max* (L.) Merr.] has made neighbouring crops such as peanut, more likely to be subjected to off-target movement (physical drift and/or volatility) and/or spray tank contamination of non-registered herbicides (Lassiter *et al.*, 2007; Leon *et al.*, 2014; Prostko *et al.*, 2011). In the U.S., it has been reported that 86% of the cotton hectares are planted using stacked gene cultivars (insect and herbicide-resistant) and 95% of soybean hectares are planted using herbicide-resistant cultivars (USDA-NASS, 2023).

This expansion of herbicide-resistant crops has led to an increase in the use of both glyphosate and dicamba for weed control. Glyphosate is a broad spectrum, systemic herbicide that provides postemergence (POST) control of numerous annual and perennial broadleaf and grass weeds (Shaner, 2014). Dicamba is a systemic synthetic auxin herbicide that is used for the control of annual and perennial broadleaf weeds (Shaner, 2014).

Numerous studies have evaluated peanut response to glyphosate or dicamba applied separately (Blanchett *et al.*, 2015; Grey and Prostko, 2010; Johnson *et al.*, 2012; Lassiter *et al.*, 2007; Leon *et al.,* 2014; Prostko *et al.*, 2011). Single exposure events of glyphosate plus dicamba at rates ranging between 1/512X and 1X have also been evaluated (Daramola *et al.* 2023; Grichar *et al.*, 2021). Collectively, the above research suggests that, although peanut injury symptoms from either dicamba or glyphosate are vastly different, yield response to these herbicides is similar. Generally, peanut yield loss from accidental exposure to either glyphosate or dicamba is a function of rate and peanut stage of growth.

Depending upon the herbicide label, two to four applications of dicamba are permitted on tolerant cotton and soybean cultivars including preplant, preemergence (PRE), and POST applications with POST application cut-off dates of 30-Jun. (soybean) and 30-Jul. (cotton) (Anonymous, 2022a; 2022b; 2023). In the dicamba-tolerant cotton and soybean production systems, dicamba is typically applied in a tank-mixture with glyphosate to increase the spectrum of weed control (Cahoon *et al.,* 2015; Striegel *et al.*, 2021). Thus, ample opportunities exist for unintentional multiple off-target exposure events of glyphosate plus dicamba to occur on near-by planted peanut. Since 2017, off-target events of glyphosate plus dicamba have been observed in commercial peanut fields across the peanut belt. However, no research has described the potential negative effects of multiple exposure events of low rates of glyphosate plus dicamba on peanut.

Therefore, the objective of this study was to determine the impact of multiple exposure events and low rates of glyphosate plus dicamba on peanut yield and grade across multiple locations in the southeast and southwest production regions of the U.S.

MATERIALS AND METHODS

During 2019 and 2020, seven land-grant universities conducted field trials, for a total of 15 site-years, investigating peanut yield/grade response to low-use rates and multiple exposures of glyphosate plus dicamba (Table 1). Six treatments were arranged in a randomized complete block design with a two (timing) by three (rate) factorial with three to four replications. Timings occurred at 30 + 60 days after planting (DAP) or 30 + 60 + 90 DAP. Research has shown that off-target movement of herbicides can range somewhere between 1/10X and 1/100X (Al-Khatib and Peterson 1999; Bailey and Kapusta, 1993; Snipes *et al.*, 1991; Snipes *et al.*, 1992). It has also been reported that spray particle drift from ground sprayers is equivalent to 1% to 8% of the total spray volume (Maybank *et al.*, 1978). Thus, if dicamba is applied at 560 g ae/ha (1X), 1% drift would be equivalent to a 1/100X rate. Therefore, glyphosate plus dicamba rates were 25.2 g ae/ha + 11.2 g ae/ha (1/50X) and 12.6 g ae/ha + 5.6 g ae/ha (1/100X), respectively. A non-treated control (NTC) was also included. Growth stage of peanut at 30, 60, and 90 DAP were beginning bloom (R1), beginning peg to beginning pod (R2 - R3), and full pod to full seed (R4 - R6), respectively (Boote 1982).

Peanut were planted in freshly prepared seedbeds with four-row plots for each treatment. The inner two rows of each plot were treated which left a two-row border on each side of the plot to minimize any off-target movement to adjacent plots. All herbicide treatments were applied using a CO_2-pressurized backpack sprayer to deliver 140 L/ha or 187 L/ha in TX (South). Herbicide application techniques varied by location but were consistent with local practices and implemented to minimize off-target movement.

Data collected included pod yield (all locations), market grade (AL, GA, OK, and TX), and pod malformations (GA and NC). Peanut yield data were obtained using commercial harvesting equipment with moistures adjusted to 10%. Peanut grades (total sound mature kernels) were obtained from local Federal/State Inspection Services using a 500 g pod sample collected from each harvested plot (USDA-AMS, 2019). Additionally, peanut pod malformation data were collected in GA and NC and were obtained by visually inspecting 100 random pods from each replication/treatment. Malformed pod shapes included any pods that were abnormal in size and/or had a "parrot-beak" shape (Figure 1).

Data were subjected to ANOVA using PROC GLIMMIX in SAS, version 9.4 (SAS Institute, Cary, NC). Peanut yield, grade, and pod abnormalities were set as the response variables with year and replication within year included in the model as random factors. Yield data was grouped by region and pooled across years. All P-values for tests of differences between least-square means were compared and separated using the Tukey-Kramer method ($P<0.10$).

Table 1. Year, state, cultivar, location, soil type, planting dates, and application dates for multi-state glyphosate plus dicamba peanut trials, 2019-2020.

Year	State	Cultivar	Location	Soil Series/Type	Planting Date	Herbicide Application			Supplemental Irrigation (Y/N)
						30 DAP[a]	60 DAP	90 DAP	
2019	Alabama	GA-06G	Brewton	Fuquay sand	16-May	14-Jun	15-Jul	14-Aug	N
	Florida	GA-06G	Jay	Orangeburg sandy loam	9-May	13-Jun	10-Jul	7-Aug	Y
	Georgia	GA-06G	Ty Ty	Fuquay sand	30-Apr	30-May	26-Jun	1-Aug	Y
	North Carolina	Bailey II	Lewiston-Woodville	Norfolk sandy loam	25-May	25-Jun	30-Jul	28-Aug	Y
	Oklahoma	Wynne	Fort Cobb	Binger fine sandy loam	15-May	6-Jun	9-Jul	7-Aug	Y
	South Carolina	Sullivan	Blackville	Fuquay sand	31-May	28-Jun	1-Jul	30-Aug	Y
	Texas (West)	GA-09B	Seminole	Patricia loamy fine sand	30-Apr	30-May	28-Jun	29-Jul	Y
	Texas (South)	GA-09B	Yoakum	Tremona loamy fine sand	24-Jun	25-Jul	26-Aug	24-Sep	Y
2020	Alabama	GA-06G	Headland	Dothan loamy sand	5-May	3-Jun	3-Jul	31-Jul	Y
	Georgia	GA-06G	Ty Ty	Tifton sand	27-Apr	25-May	22-Jun	27-Jul	Y
	North Carolina	Bailey II	Lewiston-Woodville	Norfolk sandy loam	4-May	3-Jun	30-Jun	31-Jul	Y
	Oklahoma	Wynne	Fort Cobb	Binger fine sandy loam	6-May	4-Jun	2-Jul	4-Aug	Y
	South Carolina	Sullivan	Blackville	Varina loamy sand	2-Jun	2-Jul	1-Aug	2-Sep	Y
	Texas (West)	GA-09B	Seminole	Patricia loamy fine sand	28-Apr	27-May	24-Jun	27-Jul	Y
	Texas (South)	GA-09B	Yoakum	Tremona loamy fine sand	17-Jun	17-Jul	16-Aug	15-Sep	Y

[a]DAP = days after planting.

Figure 1. Peanut pod malformations caused by glyphosate plus dicamba applied at low rates.

RESULTS AND DISCUSSION

Peanut Yield

In both regions, there were no interactions between rate and timing. In the southeast region, peanut yield was reduced 9%, regardless of application timing, when glyphosate plus dicamba was applied at the 1/50X rate (Table 2). No yield reductions with either rate or timing were observed in the southwest region. It is possible that the environmental conditions typical to the southeast region (i.e. higher rainfall and humidity) resulted in a greater yield loss in comparison to the southwest region. Herbicide absorption, translocation, and efficacy are increased under higher moisture conditions (Friesen and Dew, 1966; Sharma and Singh, 2001; Peerzada *et al.*, 2021). Single applications of glyphosate plus dicamba at 1/16X rates resulted in 0% to 28% yield reductions in previous research (Grichar *et al.*, 2021). Other research has reported yield reductions of 5% to 14% with single exposure events of 1/128X and 1/32X rates of glyphosate plus dicamba (Daramola *et al.*, 2023).

Table 2. Peanut yield as influenced by glyphosate plus dicamba at low rates by region, 2019-2020.

Rate[c]	Southeast[a]	Southwest[b]
	Yield	
	--------- kg/ha ---------	
0	5591a[d]	5160a
1/100X	5580a	5140a
1/50X	5106b	4942a

[a] Southeast= locations included are AL, FL, GA, NC, and SC. Data are averaged over year, location, and application time.

[b] Southwest = locations included are OK, TX (West), and TX (South). Data are averaged over year, locations, and application times.

[c] 1X Rate = 1260 g ae/ha glyphosate plus 560 g ae/ha dicamba.

[d] Means in the same column with the same letters are not significantly different according to the Tukey-Kramer method (P<0.10).

It is interesting to note that when applied alone, peanut has exhibited some tolerance to glyphosate. Single applications of glyphosate applied at 1/16X or 1/8X from 75 DAP to 105 DAP had no effect on peanut yield (Grey and Prostko, 2010). For a short time in the late 1980's, glyphosate (34 g ae/ha) was sold by Monsanto (now Bayer Crop Science) under the commercial trade name of Quotamaker™ as a peanut yield enhancer/growth regulator (Hawf *et al.*, 1989). However, this particular use for glyphosate was not readily adopted by peanut growers and was discontinued.

Peanut Grade

In AL, GA, and TX (West), peanut grade (total sound mature kernels) was not influenced by either rate or timing (Table 3). In 2019 in OK and TX (South), peanut grade was reduced 3% to 4% with the 1/50X rate of glyphosate plus dicamba. In 2020 in TX (South), peanut grade was reduced 1% when glyphosate plus dicamba was applied 30 + 60 + 90 DAP compared to the 30 + 60 DAP application. In previous research, peanut grade was reduced 6% to 8% when glyphosate plus dicamba, at 1/16X rate, was applied either 60 or 90 DAP (Grichar *et al.*, 2021).

Table 3. Peanut grade (total sound mature kernels) as influenced by glyphosate plus dicamba applied at low rates and multiple exposures in Alabama, Georgia, Oklahoma, and Texas, 2019-2020.[a]

	Alabama	Georgia	Oklahoma	Texas (South)		Texas (West)
Timing or Rate	2019	2019/2020[b]	2019	2019	2020	2019
	----------TSMK (%) ----------					
Timing (DAP)[c]						
30 + 60	67a[d]	75a	68a	70a	63a	79a
30 + 60 + 90	66a	74a	68a	70a	62b	79a
Rate[e,f]						
0	68a	75a	69a	72a	63a	79a
1/100X	66a	73a	68a	69ab	62a	79a
1/50X	65a	74a	66b	68b	63a	80a

[a] TSMK = % total sound mature kernels (sound mature kernels + sound splits).

[b] Averaged over two years.

[c] DAP = days after planting; averaged over rate.

[d] Means in the same column within timing or rate with the same letter are not significantly different according to the Tukey-Kramer method (P<0.10).

[e] Averaged over timing.

[f] 1X Rate = 1260 g ae/ha glyphosate plus 560 g ae/ha dicamba.

In contrast, glyphosate applied alone at 1/23X from 100 DAP to 110 DAP increased total sound mature kernels in non-irrigated peanut but had no effect on the grade of irrigated peanut (Lamb *et al.,* 2017). This effect was attributed to glyphosate's efficacy on flower termination. It is important to note that one percentage point of total sound mature kernels has an estimated value of $5.51/1000 kg (W.S. Monfort, pers. communication, 2025).

Peanut Pod Malformations

In GA, time of application had no effect on peanut pod malformations (Table 4). In 2019, peanut pod malformations were increased by 4% to 5% by 1/50X and 1/100X rates of glyphosate plus dicamba but not in 2020.

In NC, peanut pod malformations were greater (7% to 8%) when glyphosate plus dicamba was applied 30 + 60 + 90 DAP. Additionally, the 1/50X rate increased peanut pod malformations (9% to 11%) in both years while the 1/100X rate only increased pod malformations in 2020 (9%). Pod malformations in NC are a potential concern for Virginia-market types that are sold in-shell.

In soybean, pod malformations were 10% greater in treatments containing glyphosate plus dicamba when compared to dicamba alone when applied after the R3 stage of growth (Jones *et al.*, 2019). It is likely that the combination of glyphosate plus dicamba at low rates and multiple exposures can have an hormesis effect on peanut pods in certain situations (Brito *et al.*, 2018; Jalal *et al.,* 2021).

SUMMARY AND CONCLUSIONS

Based upon these results, off-target movement of glyphosate plus dicamba at rates ≤1/100X is unlikely to result in significant peanut yield and grade losses. However, glyphosate plus dicamba drift may result in abnormal pod development which could be a major concern for peanut producers in the Virginia-Carolina region where peanut is grown primarily for the in-shell market. Off-target movement of glyphosate plus dicamba, and all other pesticides, is undesirable and multiple mitigation practices need to be implemented to minimize this potential problem.

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Table 4. Peanut pod malformations as influenced by glyphosate plus dicamba applied at low rates and multiple exposures in Georgia and North Carolina, 2019-2020.

Timing or Rate	Georgia		North Carolina	
	2019	2020	2019	2020
	---------- Abnormal Pods (%) ----------			
Timing (DAP)[a]				
30 + 60	5a[b]	9a	7b	5b
30 + 60 + 90	6a	10a	14a	13a
Rate[c,d]				
0	2b	7a	6b	3b
1/100X	6a	10a	8b	12a
1/50X	7a	11a	17a	12a

[a] DAP = days after planting; averaged over rate.

[b] Means in the same column within timing or rate with the same letter are not significantly different according to the Tukey-Kramer method (P<0.1).

[c] Averaged over timing.

[d] 1X Rate = 1260 g ae/ha glyphosate plus 560 g ae/ha dicamba.

LITERATURE CITED

Al-Khatib K. and D. Peterson. 1999. Soybean (*Glycine max*) response to simulated drift from selected sulfonylurea herbicides, dicamba, glyphosate, and glufosinate. Weed Technol. 13:264-270.

Anonymous. Engenia® herbicide label. Research Triangle Park, NC, BASF Corporation. 2022a.

Anonymous. Xtendimax® herbicide label. St. Louis, MO. Bayer Crop Science LP. 2022b.

Anonymous. Tavium® herbicide label. Greensboro, NC. Syngenta Crop Protection, LLC. 2023.

Bailey J.A. and G. Kapusta. 1993. Soybean (*Glycine max*) tolerance to simulated drift of nicosulfuron and primisulfuron. Weed Technol. 7:740-745.

Blanchett B.H., T.L. Grey, E.P. Prostko, and T.M. Webster. 2015. The effect of dicamba on peanut when applied during vegetative growth stages. Peanut Sci. 42:109-120.

Boote K.J. 1982. Growth stages of peanut (*Arachis hypogaea* L.). Peanut Sci. 9:35-40.

Brito I., L. Tropaldi, C.A. Carbonari, and E.D. Velini. 2018. Hormetic effects of glyphosate on plants. Pest Manag. Sci. 74:1064-1070.

Cahoon C.W., A.C. York, D.L. Jordan, W.J. Everman, R.W. Seagroves, A.S. Culpepper, and P.M. Eure. 2015. Palmer amaranth (*Amaranthus palmeri*) management in dicamba-resistant cotton. Weed Technol. 29:758-770.

Daramola O.S, P. Kharel, J.E. Iboyi, and P. Devkota. 2023. Response of peanut (*Arachis hypogaea* L.) to sublethal rates of dicamba plus glyphosate at different growth stages. Agron. J. 115:1694-1704.

Friesen H.A. and D.A Dew. 1966. The influence of temperature and soil moisture on the phytotoxicity of dicamba, picloram, bromoxynil, and 2,4-D ester. Can. J. Plant Sci. 46:653-660.

Grey T.L. and E.P. Prostko. 2010. Physiological effects of late season glyphosate applications on peanut (*Arachis hypogaea*) seed development and germination. Peanut Sci. 37:124-128.

Grichar W.J., P.A. Dotray, and T.A. Baughman. 2021. Peanut (*Arachis hypogaea* L.) response to glyphosate plus dicamba combinations. J. Adv. in Agri. 12:22–30.

Hawf L.R., G.A. Dixon, J.F. Mason, D.W. Rushing, and S.L. Sherrick. 1989. MON-20004, a plant growth regulator for peanuts. Proc. South. Weed Sci. Soc. 42:331.

Jalal A., J. Carlos de Oliveira Junior, J.S. Riberio, G.C. Fernandes, G.G. Mariano, V.D. Rezende Trindade, and A. Rodrigues doe Reis. 2021. Hormesis in plants: Physiological and biochemical responses. Ecotox. and Environ. Safety 207:111225.

Johnson A.W., N.A. Minton, T.B. Brenneman, J.W. Todd, G.A Herzog, G.J. Gascho, S.H. Baker, and K. Bondari. 1998. Peanut-cotton-rye rotations and soil chemical treatments for managing nematodes and thrips. J. of Nematol. 30(2):211-225.

Johnson V.A., Fisher L.R., Jordan D.L., Edmisten K.E., Stewart A.M., and A.C. York. 2012. Cotton, peanut, and soybean response to sublethal rates of dicamba, glufosinate, and 2,4-D. Weed Technol. 26:195-206.

Johnson III W.C., Brenneman T.B., Baker S.H., Johnson A.W., Sumner D.R., and B.G. Mullinix Jr. 2001. Tillage and pest management considerations in peanut-cotton rotation in the southeastern Coastal Plain. Agron. J. 93:570-576.

Jones G.T., J.K. Norsworthy, T. Barber, E. Gbur, and G.R. Kruger. 2019. Effect of low doses of dicamba alone and in combination with glyphosate on parent soybean and offspring. Weed Technol. 33:17-23.

Lamb M.C, R.B. Sorenson, C.L. Butts, P.M. Dang, C.Y. Chen, and R.S. Arias. 2017. Chemical interruption of late season flowering to improve harvest peanut maturity. Peanut Sci. 44:60-65.

Lassiter B.R., I.C. Burke, W.E. Thomas, W.A. Pline-Srnic, D.L. Jordan, J.W. Wilcut, and G.W. Wilkerson. 2007. Yield and physiological response of peanut to glyphosate drift. Weed Technol. 21:954-960.

Leon R.G., J.A. Ferrell, and B.J. Brecke. 2014. Impact of exposure to 2,4-D and dicamba on peanut injury and yield. Weed Technol. 28:465-470.

Maybank J., K. Yoshida, and R. Grover. 1978. Spray drift from agricultural pesticide applications. Air Pollut. Control. Assoc. J. 28:1009-1014.

Peerzada A.M., A. Williams, C. O'Donnell, and S. Adkins. 2021. Effect of soil moisture regimes on the glyphosate sensitivity and morpho-physiological traits of windmill grass (*Chloris truncata* R.Br.), common sowthistle (*Sonchus oleraceus* L.), and flax fleabane [*Conyza bonariensis* (L.) Cronq.]. Plants 10(11):2345.

Prostko E.P., T.L. Grey, M.W. Marshall, J.A. Ferrell, P.A. Dotray, W.J. Grichar, B.J. Brecke, and J.W. Davis. 2011. Peanut yield response to dicamba. Peanut Sci. 38:61-65.

Shaner D.L., 2014. Herbicide Handbook. 10th Edition. Weed Science Society of America, Champaign, IL. 513 p.

Sharma S.D. and M. Singh. 2001. Environmental factors affecting absorption and bio-efficacy of glyphosate in Florida beggarweed (*Desmodium tortuosum*). Crop Prot. 20:511-516.

Snipes C.E, J.E. Street, and T.C. Mueller. 1991. Cotton (*Gossypium hirsutum*) response to simulated triclopyr drift. Weed Technol. 5:493-498.

Snipes C.E, J.E. Street, and T.C. Mueller. 1992. Cotton (*Gossypium hirsutum*) injury from simulated quinclorac drift. Weed Sci. 40:106-109.

Striegel S, M.C. Oliveira, R.P. DeWerff, D.E. Stoltenberg, S.P. Conley, and R. Werle. 2021. Influence of postemergence dicamba/glyphosate timing and inclusion of acetochlor as a layered residual on weed control and soybean yield. Front. Agron. 3:788251.

USDA-AMS [United States Dept. of Agriculture-Agricultural Marketing Service]. 2019. Farmer Stock Peanuts-Inspection Instructions. On-line at: https://www.ams.usda.gov/sites/default/files/media/FarmersStockPeanutsInspectionInstructions.pdf.

USDA-NASS [United States Dept. of Agriculture-National Agricultural Statistics Service]. 2023. Acreage. On-line at: https://downloads.usda.library.cornell.edu/usda-esmis/files/j098zb09z/hh63v8465/zg64w269x/acrg0623.pdf.

USDA-NASS [United States Dept. of Agriculture-National Agricultural Statistics Service]. 2024. Crop Production - 2023 Summary. On-line at: https://downloads.usda.library.cornell.edu/usda-esmis/files/k3569432s/ns065v292/8910md644/cropan24.pdf.