Research Note

GLYPHOSATE ON TOMATO AND SWEET PEPPER YIELDS[1]

Glyphosate [N-(phosphonomethyl) glycine] is a broad spectrum herbicide, effective on deep-rooted perennial weed species, annual and biennial species of grasses, sedges, and broad-leaved weeds.[2] Selectivity is attained by directing sprays to weeds. Glyphosate at 4.68, 9.36 and 18.72 L/ha, applied directly to weeds at approximately 2-month intervals, provided excellent weed control in plantains.[3] Glyphosate was also effective on coffee plantations.[4] In Puerto Rico this herbicide is recommended for plantains, bananas and coffee.[5] In many vegetable crops, glyphosate can be used as a preplant treatment against actively growing weeds, but before emergence of crops.[6] The strong adsorption and rapid inactivation of glyphosate by clay and muck soils allowed its use without detrimental effects on several crops.[7,8] However, recent studies demonstrated that under certain conditions, glyphosate may cause crop injury when used before planting or emergence of some crop species.[9,10] Eberbach et al.[11] suggested that inactivation of glyphosate is low in soils of high sand content.

Field experiments with Big Set tomato (*Lycopersicon esculentum* Mill.) and Cubanelle sweet pepper (*Capsicum annuum* L.) were conducted at the Lajas Research Center in 1983. Tomato and sweet pepper seedlings were transplanted in a Vertisol (Udic Chromusterts, very fine, montmorillonitic, isohyperthermic, pH 6.5 and 2.8% organic matter content) April 15, 1983. In both experiments the experimental design was a randomized complete block with five treatments and four replications. For tomato, the individual plots consisted of two rows, 6.4 m long and 1.8 m apart. Plants were spaced 0.9 m apart in the row. Sweet pepper plots consisted of two rows,

[1]Manuscript submitted to Editorial Board April 28, 1986.

[2]Baird, D. D., R. P. Upchurch, W. B. Homesley and J. E. Franz, 1971. Introduction to new broad spectrum postemergence herbicide class with utility for herbaceous perennial weed control. Proc. N. Cent. Weed. Contr. Conf. 26: 64-8.

[3]Liu, L. C., J. A. Rodríguez-García and N. Semidey-Laracuente, 1981. Glyphosate for weed control in Plantain. J. Agric. Univ. P. R. 65: 317-25.

[4]Boneta-García, E. B., 1983. Effect of three post-emergence herbicides on coffee growth and weed control. J. Agric. Univ. P. R. 67: 262-68.

[5]Acín-Díaz, N. M., H. O'Farril-Nieves and R. Montalvo Zapata, 1983. Lista preliminar de plaguicidas con permiso de uso en plátanos, guineos y café. Plaguicidas al Día 4 (1): 2-3.

[6]Acín-Díaz, N. M., H. O'Farril-Nieves and R. Montalvo Zapata, 1984. Plaguicidas con permiso de uso en Hortalizas. Plaguicidas al Día 5 (2): 2-13.

[7]Sprankle, P., W. F. Meggitt and D. Penner, 1975. Rapid inactivation of glyphosate in the soil. Weed Sci. 23: 224-28.

[8]Sprankle, P., W. F. Meggitt and D. Penner, 1975. Adsorption, mobility, and microbial degradation of glyphosate in the soil. Weed Sci. 23: 229-34.

[9]Salazar, L. C. and A. P. Appleby, 1982. Germination and growth of grasses and legumes from seeds treated with glyphosate and paraquat. Weed Sci. 30: 235-37.

[10]Salazar, L. C. and A. P. Appleby, 1982. Herbicidal activity of glyphosate in soil. Weed Sci. 30: 463-66.

[11]Eberbach, P. L. and L. A. Douglas, 1983. Persistence of glyphosate in sandy loan. Soil Biol. Biochem. 5: 485-487.

3.0 m long and 1.8 m apart. Plants were set 0.3 m apart. Fertilizing, irrigation and pest control practices were performed according to the needs of individual crops.[12] Glyphosate at 0.41, 0.82 and 1.64% v/v concentration was applied directly to weeds April 26 and June 2 in both experiments. A hand-pump sprayer with a protective shield at the nozzle tip was used to avoid herbicide drift. Hand-weeded check plots were hoed 2, 5 and 9 weeks after planting. Tomatoes were harvested five times from June 13 to July 6; and peppers four times from June 17 to July 29. Yields were recorded on the basis of commercially acceptable fruits.

The predominant weed species in the experimental area listed in decreasing order of abundance were junglerice [*Echinochloa colonum (L.) Link*], *johnsongrass [Sorghum halepense* (L.) Pers.], purple nutsedge (*Cyperus rotundus* L.), morningglory [*Ipomoea tiliacea* (Wild.) Choisy], spurge (*Euphorbia heterophylla* L.) and purslane (*Portulaca oleracea* L.). Table 1 shows data on weed control and number of weeds per square meter. The first postemergence application of glyphosate at each of three concentrations gave complete control of weed seedlings in tomato and sweet pepper. In both crops, weed control by glyphosate was from good (79%) to excellent (95%) at the time of harvest. At this time weed control performance achieved by the glyphosate treatments was better than that obtained by three hand weedings on both crops. The number of weeds/m² on glyphosate treated plots was significantly lower than on weeded plots, except on sweet pepper plots treated with glyphosate at 0.41%. Weed control performance of glyphosate on sweet peppers improved with increased concentrations of the herbicide at the second application. No phytotixicity symptoms in tomato or sweet pepper plants were observed since sprays were directed to weeds.

The following tabulation shows the effect of directed postemergence treatments of glyphosate on marketable fruit yield of tomato and sweet pepper.

Treatments	*Fruit Yield (kg/ha)*[13]	
	Tomatoes	*Sweet peppers*
Glyphosate 0.41%[14]	13,784 b	14,156 a
Glyphosate 0.82%	15,024 b	13,395 a
Glyphosate 1.64%	14,713 b	12,766 a
Hand-weeded check	22,264 a	15,929 a
Non-weeded check	8,363 c	504 b
CV (%)	18	31

TABLE 1.—*Weed control in tomatoes and sweet peppers after two glyphosate treatments directed to weeds*

Treatments	Weed control at 4 and 9 weeks after transplanting					
	Tomatoes			Sweet peppers		
	4 weeks	9 weeks	Weed no.[1]	4 weeks	9 weeks	Weed no.[1]
	%	%	m^2	%	%	m^2
Glyphosate 0.41%[2]	100	91	7 a	100	79	18 ab
Glyphosate 0.82%	100	91	7 a	100	91	8 a
Glyphosate 1.64%	100	90	8 a	100	95	4 a
Hand-weeded check	100	80	16 b	95	58	36 b
Non-weeded check	0		80 c	0	0	86 c

[1]Means followed by the same letters do not differ significantly at P=.05; Duncan's multiple range test.

[2]Isopropylamine salt of Glyphosate equivalent to 1% v/v of Roundup commercial herbicide.

[12]Anonymous, 1979. Conjunto Tecnológico para la Producción de Hortalizas. Publ. 102 Esta. Exp. Agric. Univ. P. R.

The highest tomato yield (22,264 kg/ha) was obtained with three handweedings. This yield was significantly higher than those obtained with glyphosate at any of the three concentrations. There is no definite explanation for lower yields in glyphosate-treated plots. Probably, glyphosate affected the plants through the root system; thus withoud apparent symptoms, these tomato plants yielded less. From our results and those reported previously in literature[9,10,11] the use of glyphosate seems too risky for tomato and similar crops. There were no significant differences on pepper yields between glyphosate treated plots and handweeded plots. Pepper yield was lower than expected. Peppers were picked only four times because pepper plants were affected by root rot disease caused by the fungi *Phytophthora parasitica* and *Fusarium lateritium*. Under normal conditions peppers are picked six times or more during the growth span.

Nelson Semidey
Luis Almodóver
Department of Crop Protection

[13] Means followed by the same letters do not differ significantly at P = .05; Duncan's multiple range test.

[14] Isopropylamine salt of Glyphosate equivalent to 1% v/v of Roundup commercial herbicide.