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Yellow Nutsedge (*Cyperus esculentus*) Growth and Tuber Production in Response to Increasing Glyphosate Rates and Selected Adjuvants

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Greenhouse studies were conducted to evaluate the influence of selected adjuvants on glyphosate efficacy on yellow nutsedge and tuber production. Glyphosate was applied at 0, 0.25, 0.43, 0.87, 1.26 (1× rate), and 1.74 kg ae ha^{-1} at 31 d after yellow nutsedge was planted. Each rate was mixed with one of the following adjuvants: ammonium sulfate (AMS), AMS plus nonionic surfactant (NIS), or AMS plus an experimental adjuvant (W-7995) plus NIS. Plants were evaluated for injury and for the number and size of tubers produced. Dose–response curves based on log-logistic models were used to determine the effective glyphosate rate plus adjuvant that provided both 90% effective dose (ED_{90}) for yellow nutsedge injury and reduced tuber production. Addition of NIS to glyphosate plus AMS resulted in the greatest yellow nutsedge injury at 28 d after treatment (DAT). Addition of the experimental adjuvant plus NIS resulted in injury similar to NIS alone. The ED_{90} for injury at 28 DAT was 2.12 kg ha^{-1} with glyphosate plus AMS and NIS compared with 2.18 kg ha^{-1} for W-7995 plus NIS and 3.06 kg ha^{-1} with AMS alone. The ED_{90} rates with different adjuvants represent 168%, 173%, and 243% of the highest glyphosate rate (1.26 kg ha^{-1}) labeled for application on many glyphosate-resistant crops. However, the estimated ED_{90} to reduce small, medium, large, and total tubers were 1.60, 1.50, 1.63, and 1.66 kg ha^{-1}, respectively. Increases in labeled rates of glyphosate may be required to reduce yellow nutsedge tuber production in field conditions. Use of lower glyphosate rates should be discouraged because it may increase tuber production and exacerbate yellow nutsedge expansion in infested fields.

Nomenclature: Glyphosate; yellow nutsedge, *Cyperus esculentus* L. CYPES.
Key words: Adjuvants, yellow nutsedge tubers, furrow irrigated systems.

Se realizaron estudios de invernadero para evaluar la influencia de adyuvantes seleccionados en la eficacia de glifosato en el control de *Cyperus esculentus* y la producción de tubérculos. El glifosato se aplicó a 0, 0.25, 0.43, 0.87, 1.26 (1× dosis) y 1.74 kg ea ha^{-1} a los 31 días después de sembrar el *C. esculentus*. Cada dosis se mezcló con uno de los siguientes adyuvantes: sulfato de amonio (AMS); o AMS más un surfactante no iónico (NIS); o AMS más un adyuvante experimental (W-7995) más NIS. Las plantas se evaluaron por el daño causado en ellas y el número y tamaño de los tubérculos producidos. Se usaron curvas de dosis-respuesta basadas en modelos log-logísticos para determinar la dosis efectiva de glifosato más el adyuvante, que proporcionara 90% de daño a *C. esculentus* (ED_{90}) y una producción menor de tubérculos. La adición de NIS al glifosato más AMS originó el mayor daño a *C. esculentus* a los 28 días después de la aplicación (DDA). La adición del adyuvante experimental más NIS resultó en un daño similar a la aplicación de NIS por sí solo. El daño ED_{90} a los 28 DDA fue 2.12 kg ha^{-1} con glifosato más AMS y NIS, comparado a 2.18 kg ha^{-1} para W-7995 más NIS y 3.06 kg ha^{-1} con AMS solo. Las dosis ED_{90} con diferentes adyuvantes representan 168, 173 y 243% de la dosis más alta de glifosato (1.26 kg ha^{-1}) recomendada para su aplicación en muchos cultivos resistentes a glifosato. Sin embargo, la dosis estimada ED_{90} para reducir pequeños, medianos, grandes y el total de tubérculos fue 1.60, 1.50, 1.63 y 1.66 kg ha^{-1}, respectivamente. Incrementos en las dosis recomendadas de glifosato podrían ser necesarios para reducir la producción de tubérculos de *C. esculentus* en condiciones de campo. No debería recomendarse el uso de dosis más bajas de glifosato porque esto podría incrementar la producción de tubérculos y exacerbar la expansión de *C. esculentus* en campos infestados.

Yellow nutsedge is a perennial weed found throughout the world in many crop production systems (Anderson 1999; Holm et al. 1991; Schippers et al. 1995). It is naturalized within the United States, where it was first reported in the northeastern states in 1889 (DeFelice 2002). Yellow nutsedge has since spread to nearly all crop producing regions of the United States. The effect of yellow nutsedge on production agriculture has led to its listing as a prohibited noxious weed in 10 states (Anderson 1999). Hauser (1971) suggested that the increase of yellow nutsedge in agricultural fields is largely due to reduced competition from annual weeds, which tend to have effective control measures.

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Populations of yellow nutsedge can expand and contract in individual fields based on a variety of environmental and management factors. However, given its perennial nature, yellow nutsedge remains a problem once it produces mature tubers in a field. Control of yellow nutsedge is difficult because reproduction is mainly by underground vegetative propagules (rhizomes and tubers), which persist for 3 to 5 yr (DeFelice 2002). Population dynamic models have indicated that farming operations were the main cause of yellow nutsedge dispersal in fields (Schippers et al. 1993). Tillage caused a threefold increase in infestation expansion level compared with no tillage. Tuber adherence to field machinery during physical weed management activities is a significant cause of the horizontal distribution of yellow nutsedge in infested fields (Schippers et al. 1993; Webster 2005).

Yellow nutsedge is an important weed problem of agricultural fields in the Treasure Valley region of eastern