Proc. Fla. State Hort. Soc. 110:318-320. 1997.

EFFECT OF INCREASING PURPLE NUTSEDGE (*CYPERUS ROTUNDUS*) DENSITIES ON CILANTRO (*CORIANDRUM SATIVUM*) YIELD[1]

JOSE P. MORALES-PAYAN, BIELINSKI M. SANTOS
AND WILLIAM M. STALL
Horticultural Sciences Department
IFAS, University of Florida
Gainesville, FL 32611

Additional index words. Weed competition, nutsedge interference.

Abstract. **Field studies were conducted to determine the effect of season-long interference of purple nutsedge (*Cyperus rotundus* L.) on cilantro (*Coriandrum sativum* L.) yield. Cilantro was planted in 1-m² microplots at a 33 by 10 cm distance in a three row per bed system (approximately 30 plants per m²). Purple nutsedge was established randomly on the beds at densities of 0, 10, 20, 30, 40, or 50 plants per m² and allowed to interfere with cilantro throughout the crop's growing season (35 days). As purple nutsedge density increased, cilantro yield decreased. Yield losses were 12.8% at 10 purple nutsedge plants per m², and 60.6% at 50 purple nutsedge plants per m². A negative quadratic equation characterized the relationship between purple nutsedge density and cilantro yields.**

Coriandrum sativum, commonly known as cilantro and coriander, is an important seasoning herb in tropical and subtropical regions. Among crop protection practices, weed management plays a predominant role in cilantro production (Morales-Payan, 1995). Although documented observations and experimental data on the interactions of cilantro and weeds are scarce, this crop is considered to have a low degree of competitiveness against weeds, and maintaining weed-free cilantro fields is generally recommended (Morales-Payan, 1995). In commercial cilantro fields in the Dominican Republic, it was estimated that crop yield was reduced by approximately 90% when a mixed stand of pigweeds (*Amaranthus* spp.), hogweed (*Boerhavia erecta*), spider plant (*Cleome viscosa*), purple nutsedge, barnyardgrass (*Echinochloa colona*), goosegrass (*Eleusine indica*), bitter weed (*Parthenium hysterophorus*) and green foxtail (*Setaria viridis*) was allowed to interfere with the herb season-long (Morales-Payan et al., 1997). It has also been reported that in India weed mixtures reduced cilantro seed productivity by 40.4% and its seed oil yield by 37% (Kothari et al., 1989).

In cilantro, weeds are usually controlled by hand pulling and with small hand-cultivation tools. Grasses and most broadleaf weeds can be suppressed with herbicides such as atrazine, DCPA, fuchloralin, linuron, metribuzin, napropamide, oxadiazon, pendimethalin, prometrine, propanil, and trifluralin (Kothari et al., 1989; Zheljazkov and Zhalnov, 1995), but those materials do not provide satisfactory control of purple nutsedge (Stall et al., 1996). While several herbicides such as acifluorfen, bentazon, imazethapyr, linuron, and oxyfluorfen are currently being tested for utilization in this crop (Santos et al., 1997), the lack of labeled materials for the control of purple nutsedge makes this species one of the most troublesome weeds in cilantro fields. This is more so because ample nitrogen (N) supply is usually necessary in order to obtain good cilantro yields (Baboo and Rana, 1995; Morales-Payan, 1995; Santos et al., 1996; Tiwari and Banafar, 1995), and it has been reported that increasing N fertilization rates increases the competitive ability of purple nutsedge against cilantro (Morales-Payan et al., 1997).

The effect of purple nutsedge interference has been documented for several vegetable crops. When allowed to interfere during the complete crop season, purple nutsedge reduced the yield of dry beans (*Phaseolus vulgaris*) by 81% (William, 1973), radish (*Raphanus sativus*) by 70% (Santos et al., 1996), lettuce (*Lactuca sativa*) by 54% (Morales-Payan et al., 1996), cucumber (*Cucumis sativus*) by 41%, and cabbage (*Brassica oleracea*) by 35% (William and Warren, 1975). While purple nutsedge is known to be a stronger competitor than cilantro (Morales-Payan et al., 1997), there are no reports quantifying the interference effect of different purple nutsedge population densities on the yield of this herb species. The objective of this study was to determine the effect of increasing purple nutsedge population densities on the yield of cilantro.

Materials and Methods

Field experiments were performed during spring of 1997 in Santo Domingo, Dominican Republic. Purple nutsedge and 'Criollo' cilantro from the Dominican Republic were utilized. A single crop population density (30 plants per m²) was used based on local production recommendations. Cilantro was direct-seeded on 1-m-wide soil beds, in a 3-row per bed system with planting distances of 33 cm between rows and 10 cm between plants. Sprouted purple nutsedge tubers were randomly transplanted on the soil beds among cilantro plants, at densities of 10, 20, 30, 40, or 50 plants per m². Nutsedge plants were allowed to interfere season long (35 days) with the crop. A control treatment (nutsedge-free) was also established. Plots were managed according to recommended cilantro production practices. Fertilization was achieved by broadcasting 50, 20, and 40 kg N-P-K kg·ha^{-1} prior to planting. Overhead irrigation was utilized to maintain plots close to field capacity.

A randomized complete block design with six replications was utilized. The experimental units were 1-m² microplots containing 40 cilantro plants and 0 to 50 nutsedge plants depending on the treatment. Cilantro and nutsedge aboveground biomass were separately harvested 35 days after cilantro emergence. Cilantro fresh and dry shoot weight, and purple nutsedge shoot dry weight were determined. Collected plant material was dried in a conventional air oven at 70 C for 5 days. Cilantro shoot biomass yield loss as a function of nutsedge density was calculated. Analysis of variance and regression analysis were used to determine differences among treatments and patterns of cilantro yield response to purple nutsedge population densities.

Results and Discussion

There was a significant effect of purple nutsedge population densities on cilantro fresh and dry foliage yield. As pur-

[1]Florida Agricultural Experiment Station Journal Series No. N-01480.

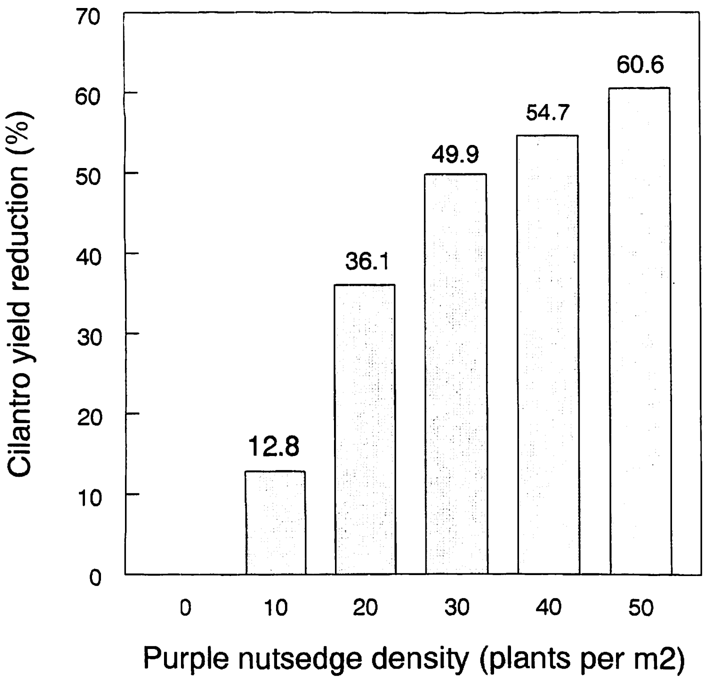

Figure 1. Effects of varying purple nutsedge densities on cilantro yield reductions.

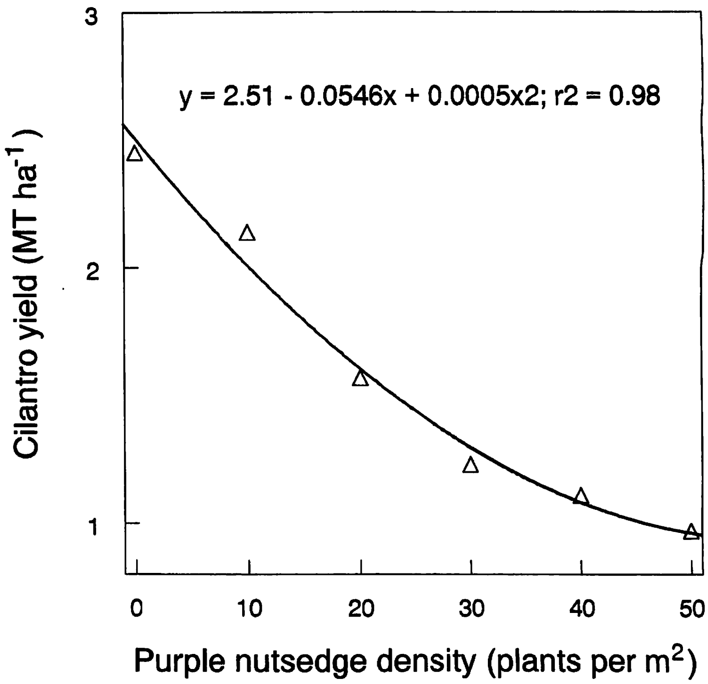

Figure 2. Effects of varying purple nutsedge densities on cilantro dry matter yield.

ple nutsedge density increased, cilantro biomass yield decreased. Since both fresh and dry weight followed a similar pattern of decrease as nutsedge densities increased, only the results for dry matter yield will be shown. Yield losses were 12.8% with 10 purple nutsedge per m^2 and 60.6% with 50 purple nutsedge per m^2 (Fig. 1). A negative quadratic regression equation characterized the relationship between purple nutsedge density and cilantro dry weight $y = 2.51 - 0.0546x + 0.0005x^2$; $r^2 = 0.98$ (Fig. 2), where y represents cilantro dry weight and x is purple nutsedge density.

Nutsedge population densities of over 50 plants per m^2 are common in nutsedge-infested fields. The fact that even nutsedge population densities as low as 10 plants per m^2 were capable of reducing cilantro yield by nearly 13% appear to justify the need for nutsedge suppression in this herb crop, even at densities usually considered to be low for this weed. Moreover, the commonly found nutsedge population densities of 50 plants per m^2 caused a cilantro yield reduction of nearly 60%, proving that unchecked nutsedge interference can be devastating for the yield of this herb crop.

Nutsedge has been known to compete with crops for light, nutrients, and water, as well as to release allelochemical compounds that interfere with the normal growth and productivity of the crop (Holm et al., 1991). In this experiment, water was supplied by overhead irrigation maintaining soil moisture near field capacity, making competition for water unlikely to be a determining factor in the effects of nutsedge on cilantro.

Cilantro and other crops in the Apiaceae family, such as parsley (*Petroselinum* spp.) and spiny cilantro (*Eryngium foetidum*), are known to develop their root systems slowly, which retards their mineral nutrient uptake from the soil and consequently makes these species weak competitors for mineral nutrients (Morales-Payan, 1995). It is likely that the presence of increasing population densities of purple nutsedge depleted the N supply in the soil at a rate that prevented cilantro from obtaining adequate amounts of nutrients necessary for its normal growth and productivity.

Light interception by the weed and the crop was not measured. However, it was observed that nutsedge canopy was denser as its population density increased. Even though cilantro and nutsedge reached approximately the same height (about 40 cm tall), increasing competition for light is likely to have occurred due to the close proximity of both species in the field. Because of the high light intensity requirement of cilantro (Morales-Payan, 1995), interception of light by nutsedge could have been an important factor in the interference of nutsedge and cilantro.

In previous experiments in which the competitive ability of nutsedge against cilantro was studied, no evidence of nutsedge allelopathic effects on this crop were detected (Santos et al., 1997). Nevertheless, under the conditions of the present study, allelopathy might have played a role in the weed-crop relationship, and therefore putative allelopathic effects of nutsedge on cilantro can not be discarded as a partial cause of crop yield loss. However, the information derived from this experiment does not allow one to draw a conclusion about allelopathic nutsedge effects on cilantro yield. Thus, future research should concentrate on the roles of competition for light and mineral nutrients, as well as on allelopathy as the most likely factors influencing nutsedge-cilantro interference relationships under irrigated field conditions.

Literature Cited

Baboo, R. and N. S. Rana. 1995. Effect of cutting management, nitrogen and phosphorus on growth and yield of coriander (*Coriandrum sativum*). Indian J. of Agron. 40(2):253-255.

Holm. L. G., D. L. Plucknett, J. V. Pancho and J. P. Herberger. 1991. The World's Worst Weeds: Distribution and Biology. Krieger Publ. Co. Malabar, FL., p. 8

Kothari, S. K., J. P. Singh and K. Singh. 1989. Chemical weed control in Bulgarian coriander (*Coriandrum sativum* L.). Trop. Pest Manag. 35(1):2-5.

Morales-Payan, J. P., B. M. Santos, W. M. Stall and T. A. Bewick. 1997. Influence of nitrogen fertilization on the competitive interactions of cilantro (*Coriandrum sativum*) and purple nutsedge (*Cyperus rotundus*). J. Herbs, Spices and Medic. Plants (in press).
Morales-Payan, J. P., B. M. Santos and T. A. Bewick. 1996. Purple nutsedge (*Cyperus rotundus* L.) interference on lettuce under different nitrogen levels. Proc. South. Weed Sci. Soc. 49:201.
Morales-Payan, J. P. 1995. Cultivo de Cilantro, Cilantro Ancho y Perejil. Fundacion de Desarrollo Agropecuario. Boletin Tecnico No 25. Santo Domingo, Dominican Republic. 26 pp.
Santos, B. M., J. P. Morales-Payan and W. M. Stall. 1997. Tolerance of cilantro (*Coriandrum sativum*) to postemergence herbicides. Proc. Caribb. Food Crop Soc. 33:(in press).
Santos, B. M., J. P. Morales-Payan and T. A. Bewick. 1996. Purple nutsedge (*Cyperus rotundus* L.) interference on radish under different nitrogen levels. Weed Sci. Soc. Amer. Abstr. 36:69.
Stall, W. M., J. A. Dusky and J. P. Gilreath. 1996. Estimated effectiveness of recommended herbicides on selected common weeds in Florida vegetables. pp. 343-346. In: D. Colvin, et al. (eds.), 1996 Florida Weed Control Guide. Fla. Coop. Ext. Serv. Circ. SP-53.
Tiwari, R. J. and R. N. S. Banafar. 1995. Application of nitrogen and phosphorus increases seed yield and essential oil of coriander. Indian Cocoa, Arecanut and Spices J. 19(2):51-55.
William, R. D. and G. F. Warren. 1975. Competition between purple nutsedge and vegetables. Weed Sci. 23:317-323.
William, R. D. 1973. Competicao entre tiririca (*Cyperus rotundus* L.) e o feijoeiro (*Phaseolus vulgaris* L.). Rev. Ceres 20:424-432.
Zheljazkov, V. and I. Zhalnov. 1995. Effect of herbicides on yield and quality of *Coriandrum sativum* L. J. Essent. Oil. Res. 7(6):633-639.

Proc. Fla. State Hort. Soc. 110:320-323. 1997.

INTERFERENCE OF WILD RADISH (*RAPHANUS RAPHANISTRUM* L.) ON CABBAGE

SHAWN T. STEED AND W. M. STALL
Horticultural Sciences Department
University of Florida, IFAS
Gainesville, FL 32611-0690

J. A. DUSKY
Everglades Research and Education Center
University of Florida, IFAS
Belle Glade, FL 33430

D. G. SHILLING
Agronomy Department
University of Florida, IFAS
Gainesville, FL 32611-0690

Additional index words. Competition, additive study, area of influence.

Abstract. **Two ecological studies determining the competitiveness of wild radish (*Raphanus raphanistrum* L.) in cabbage production were carried out in Gainesville and Live Oak, Florida. One study was the additive study, which used densities of 0, 2, 4, 8, and 16 wild radish plants per meter of cabbage row. In this study, the total density of plants per unit area changes but the crop density remains static. This study mimics growing situations where weeds appear during the growing season at different populations. Cabbage plants were harvested at ground level and weights were taken of the plant with wrapper leaves and without wrapper leaves (a marketable head). Quality factors such as head height, width, and core length were also analyzed. Weeds were harvested and dry weights were taken. The second study was the area-of-influence study. This study demonstrates the competitiveness of one wild radish in relation to the distance from the crop row. The treatments were no wild radish, one wild radish between two cabbage plants, and wild radish 15.24 cm, 20.32 cm, and 25.4 cm from the cabbage row middle (Fig. 1). The plot consisted of three cabbage plant pairs (middle, sub-terminal, and terminal pair). The same yield and quality factors were analyzed. The results of the additive study indicated that even at 16 plants/m², there was no reduction in yield or quality of cabbage at Gainesville. At Live Oak, there was a significant difference due to weed density in marketable cabbage (without wrapper leaves) yield. The area-of-influence study showed that there were no differences among treatments, but there were differences among the pair positions of cabbage fresh weight with and without wrapper leaves, head height, and head width at Gainesville. At Live Oak, there were no differences among treatments, but there was a positional effect between the middle, sub-terminal, and terminal pairs of cabbage in fresh weight with wrapper leaves.**

Introduction

Florida vegetable industry is highly dependent on winter vegetable production. A large portion of the winter crop is the production of cabbage (*Brassica oleracea* L. var. *capitata*). Florida is ranked fourth in the U.S. in cabbage production with an estimated 9,400 acres planted and a crop value of 29.7 million dollars during the 1995-1996 growing season (Fla. Agric. Statistics, 1997). A major problem with cabbage production is weed control. There are very few herbicides labeled for use in cabbage, and most are ineffective on particular weeds. Hand weeding is extremely labor intensive, costly, and not practical for growers.

Wild radish (*Raphanu.s raphanistrum* L.) is a major weed pest in Florida cabbage production areas. Selective post-emergent control of several broadleaf weeds in cabbage may be obtained with pyridate, however, this herbicide will not control wild radish. Wild radish is a winter annual broadleaf weed which germinates year-round and the seeds persist in the soil in the dormant state for many seasons (Code and

Florida Agricultural Experiment Station Journal Series No. N-01473.