YELLOW NUTSEDGE TUBER PRODUCTION IN RESPONSE TO DEPTH OF EMERGENCE

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Introduction

Yellow nutsedge has become a major problem weed in agricultural land in the Treasure Valley of eastern Oregon and southwestern Idaho. Yellow nutsedge is an introduced invasive weed that has become naturalized within the United States. It is believed that yellow nutsedge was first reported as a weed in the northeastern United States in 1889 (Defelice 2002). Control of yellow nutsedge is difficult because reproduction is mainly by underground vegetative propagules (rhizomes and tubers). Timed disking can be used to destroy young yellow nutsedge seedlings before tuber formation, but it is not an option in the Treasure Valley because beds for onion are formed during the fall season in the year preceding seeding and onion seed is planted in the spring before nutsedge begins to emerge.

Control of yellow nutsedge in the Treasure Valley will partly rely on tuber destruction by fumigation and integrated control practices that include crop rotation and herbicides. Information on the depth at which most tubers are produced and the maximum depth from which they can emerge under local conditions is essential for managing tillage and other control strategies. Prevention of tuber production is essential for sustainable yellow nutsedge control. The objective of this study was to understand the depth from which yellow nutsedge emerges and the resulting tuber production when the original tubers were placed at different depths.

Materials and Methods

The study was laid out in a randomized complete block design with four replicates. The treatments were 9 yellow nutsedge tuber planting depths starting at 2 inches and increasing in 2-inch increments to 18 inches below the surface. Each plot consisted of a 10-inch-diameter PVC pipe that was 24 inches long. The pipes were cut lengthwise on two opposing sides and then reassembled by taping the cut sides with duct tape. This procedure enables easy dissecting of the soil core in 2-inch increments at the end of the season to characterize and quantify tuber production by depth. The pipes were taken to the field and arranged in 2 parallel rows in pre-dug trenches with 18 pipes in each row. The trenches were filled so the top of the PVC pipes were at ground level. The pipes were filled with soil and then drip-irrigated for 30 min to allow the soil to settle without physical compaction. Each pipe was irrigated with 1 emitter with a 1-gal/hour flow rate. On May 5, 2006 and 2007, sprouted tubers were collected from a local field with a

severe yellow nutsedge infestation and 2 tubers planted at each pipe center, 3 inches apart at the desired treatment depth. Planting holes were made with a soil probe (4.25-inch diameter) to the desired depth. After planting and replacing the soil, the pipes were irrigated for 15 min. Thereafter, the pipes were irrigated weekly to maintain soil moisture to a 2-ft depth. A total of 94.1 inches of water was applied from May 5 to the last irrigation on October 10 of each year.

On November 7, 2006 and 2007, the pipes were dug up and placed in the greenhouse for tuber extraction. Each pipe was opened along the precut sides and the soil column was dissected in 2-inch increments and each soil segment placed in a ziplock plastic bag until processed. The tubers from each 2-inch depth increment were separated by washing and sieving and tubers were counted and weighed.

Since plowing and bed formation is done in the fall preceding onion seeding, we felt that spring seeding did not reflect what actually happens in the field. Consequently, the tubers for the 2008 study were buried in November 2007 following the same procedures as in 2006 and 2007. Date of emergence was observed and recorded starting March 2008. Plots were irrigated the same way as in 2006 and 2007.

Yellow Nutsedge Emergence Periodicity

A separate experiment was established in November 2007 to study the effect of tuber placement on emergence periodicity. Four aluminum squares measuring 1 m by 1 m each and partitioned to create 4 50-cm by 50-cm quarters were buried 15 inches deep and filled with soil to ground level. Then the soil was removed to 2-, 5-, 8-, and 12-inch depth and 100 tubers uniformly placed in each 50-cm by 50-cm compartment and soil placed back to achieve the desired planting depth for respective treatments. The study was laid out in a randomized complete block design with four replications and each compartment served as a treatment in each replication. The squares were irrigated with two emitters each to encourage tuber germination and to maintain moisture to 12-inch depth. Emergence date was monitored by counting and pulling the seedlings every other day until June 10, 2008. No tuber production was estimated from these plots. Growing degree days were recorded at the AgriMet weather station at the Malheur Experiment Station (AgriMet 2008).

Results and Discussion

Many tubers were produced in each PVC pipe regardless of the initial mother-tuber placement depth (Table 1). Analysis of variance indicated variability in the number of tubers produced in every 2-inch increment among years. There was no interaction between the depth of initial mother-tuber placement and the number of tubers produced in each 2-inch increment. On average, the greatest number of tubers was produced in the 2- to 4-inch soil depth segment regardless of the initial mother-tuber placement (Fig. 1). The cumulative number of tubers was greatest in the top 8 inches regardless of the initial mother-tuber placement. Below the 8-inch depth, tuber production decreased sharply with increasing depth. The results suggest that deep placement of tubers

through deep plowing would provide only temporary relief as the daughter tubers would be produced in the top 8 inches of the soil profile.

Yellow nutsedge emergence date was dependent on initial mother-tuber placement (Fig. 2). The first emergence was observed on April 28, May 5, May 12, and May 17, 2008 for tubers placed at 2-, 5-, 8-, and 12-inch depth, respectively. The corresponding cumulative growing degree days (GDD base 50) were 123, 179, 254, and 324, respectively. The weather information for GDD calculations was obtained from the AgriMet website (AgriMet 2008). Cumulative yellow nutsedge emergence for tubers planted at 2-, 5-, 8-, and 12-inch depth was 80, 67, 51, and 33 percent on June 4, 2008. The results indicate that time of tuber emergence is depth dependent and that most of the early cohorts emerge from shallow depths. Disking in early May would destroy emerging nutsedge seedlings and provide better control for late planted crops such as dry beans and corn. The results reinforce the recommendations for intensive long duration rotations as a measure to reduce the number of yellow nutsedge tubers in years preceding onions.

References

Defelice, M. S. 2002. Yellow nutsedge (*Cyperus esculentus* L.): snack food of the gods. Weed Technology 16:901–907.

AgriMet. 2008. The Pacific Northwest Cooperative Agricultural Weather network. http://www.usbr.gov/pn/agrimet/yearrpt.html Accessed December 22, 2008.

Table 1. Tuber production by yellow nutsedge plants originating from original tubers planted at different depths at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2006-2008.

Planting depth (inches)	Number of tubers	Tuber weight (g)	Number of tubers	Tuber weight (g)	Number of tubers	Tuber weight (g)
	2006		2007		2008	
	per ft^2					
2	2,066	279	1,923	245	2,565	401
4	1,896	266	2,284	308	2,382	333
6	1,537	206	1,868	246	2,688	394
8	1,737	269	1,716	237	2,014	318
10	1,482	232	1,876	265	2,344	357
12	900	138	1,872	252	2,567	394
14	1,142	185	2,107	285	2,215	370
16	1,694	246	1,778	251	2,148	349
18	354	54	1,239	184	1,923	301
LSD ($P = 0.05$)	214	31	108	14	130	19

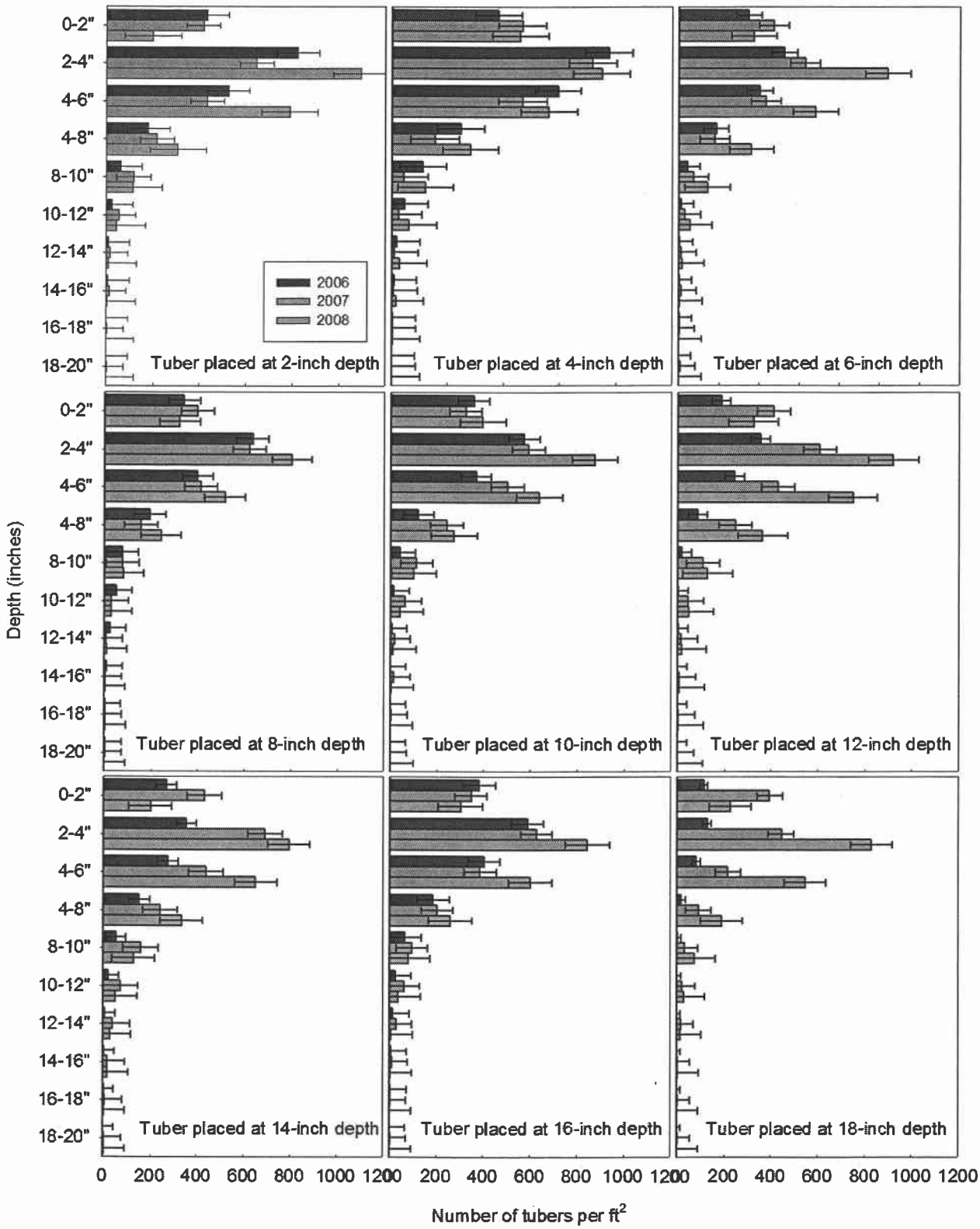

Figure 1. Yellow nutsedge tuber production and vertical distribution from mother tubers placed at different depths (2-18 inches) at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2006-2008.

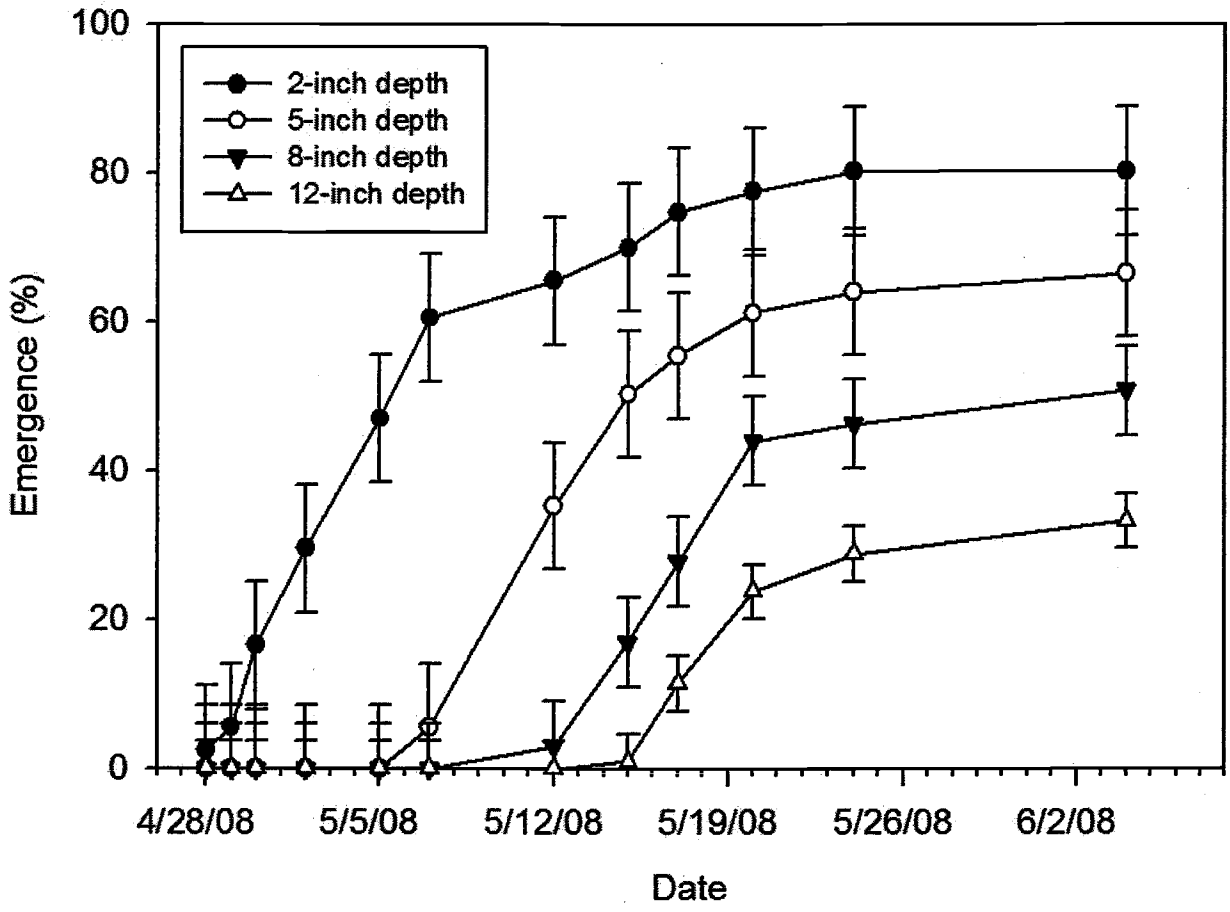

Figure 2. Cumulative yellow nutsedge emergence from tubers placed at different depths at the Malheur Experiment Station, Oregon State University, Ontario, OR, 2008.