BIOLOGY, DEVELOPMENT, AND TUBER PRODUCTION OF TWO YELLOW NUTSEDGE (*Cyperus esculentus*) VARIETIES IN THE TREASURE VALLEY

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Introduction

Yellow nutsedge (YNS) has become a problem weed in the Treasure Valley of eastern Oregon and southwestern Idaho. The negative consequences of YNS on onion production are extreme. Studies at the Malheur Experiment Station indicated that onion yield losses are between 23 and 63 percent in heavily infected fields.

The state of YNS in the Treasure Valley is evolving. In 2011 we confirmed the coexistence of *Cyperus esculentus* var. *leptostachyus* (referred to as 'true type') and *Cyperus esculentus* var. *heermannii* (referred to as 'new type'). The main visual differentiating characteristic between the varieties is the inflorescence (flower arrangement) (Fig. 1). The inflorescence of the true type has small spikelet angle, very high spikelet density, and has secondary leaf-like structures (bracts) on the spikes. The plant form for the *new type* sometimes varies to include multiple stems clustered at the base of the plant (see Fig. 1). Variety *heermannii* is considered relatively rare in the United States, and until now, it had been reported to be present only in California, Utah, and Florida (Flora of North America).

A field survey was conducted during September 2011 to document the distribution of the *new type* YNS variety. The survey covered fields on the eastern and western sides of highway 201 from near Adrian, Oregon to the area known as the 'Oregon slope' (west of Weiser, ID). The *new type* variety was found in fields planted to onion, sugar beet, and pinto beans. We are not aware of any published information in the literature addressing the growth biology, requirements for tuber germination, and tuber production output for var. *heermannii* under field conditions.

Materials and Methods

Three field studies were established during fall 2011 at the Malheur Experiment Station, Ontario, Oregon to compare the emergence, growth and development, and tuber production of the two YNS varieties (*C. esculentus* var. *leptostachyus* and *heermannii*) in the Treasure Valley.

Study 1

The study determined the timing of tuber emergence for the two YNS varieties in response to depth of tuber placement. One hundred tubers were uniformly distributed in 1.6 by 1.6-ft metal enclosures buried to 24-inch depth. Tubers of each variety were planted at 2- or 4-inch depth on November 17, 2011. Treatments were arranged in randomized complete block design with four

replications. Cumulative YNS emergence was monitored during the spring of 2012. Emerged plants were counted daily and removed.

Study 2

The two YNS varieties were compared for their date of emergence and tuber production. The study had a split-plot design with varieties forming the main plots, while tuber depth of placement was randomly assigned to each variety as subplot. Polyvinyl chloride (PVC) pipes were buried to a 20-inch depth and filled with soil. A single tuber was planted in each PVC pipe at 2-, 6-, 10-, 14-, or 18-inch depth on November 18, 2011. The PVC pipes were retrieved in October 2012 and the soil was washed to quantify YNS tubers.

Study 3

Emergence, growth and development, and tuber production for the two YNS varieties were evaluated using a split-plot design with four replications. The two YNS varieties were the main plots, while time of harvesting was the subplot. Eighty pots (each measuring 10 inches in diameter by 12 inches deep) were filled with soil and 1 tuber/pot was planted at 2-inch depth on November 17, 2011. The pots were buried with the top of the pot at ground level. Four pots were harvested biweekly starting June 15, 2012 and processed to determine plant height, number of stems, aboveground and belowground biomass, and the number of tubers.

All Studies

Tubers used in these studies were collected locally. The YNS tubers were planted into soil that was from a non-YNS infested field. Emergence was monitored starting March 2012 and irrigation commenced on April 6, 2012 for the three studies. Each pot or PVC pipe was irrigated with one emitter rated at 1 gal/hour flow rate. The metal enclosures had two emitters each. Weekly irrigation for YNS in the pots and PVC pipes lasted 8 hours. The irrigation duration was 12 hours for yellow nutsedge in the metal enclosures. A soil agitation and washing method was used to recover tubers (Felix and Ishida 2009). The data were subjected to analysis of variance, and quadratic regression models in SigmaPlot® were used to construct the graphs. The regressions presented here are on treatment averages and future regression analyses will be done on all the data.

Results and Discussion

Study 1

The *true type YNS* variety emerged more rapidly than the *new type* (Fig. 1). Emergence for the *true type* tubers planted at 2- and 4-inch depth began on April 20 at 19 percent and 13 percent, respectively. The respective cumulative germination for *true type* tubers peaked at 85 percent and 84 percent on May 9, 2012 as a function of planting depth. Planting depth also affected the emergence of the *new type* tubers. When planted at the 2-inch depth, only about 1 percent of the *new type* tubers had emerged on April 20. Emergence for the *new type* tubers planted at the 4-inch depth was noted on April 24 at only 0.3 percent. Emergence for the *new type* tubers planted at the 2- and 4-inch depth peaked on May 9 at 50 and 77 percent, respectively. Cumulative emergence for both varieties followed a quadratic relationship over time. Emergence counts were

stopped on May 9 to avoid inclusion of secondary sprouts from the same tubers. These results suggested relatively late emergence for the *new type* variety and possible differential effects of depth of tuber placement between the varieties. The management implications are that most *new type* tubers will emerge after soil-applied herbicides have been degraded. This could result in extensive tuber population buildup in infested fields.

Study 2

Total tuber production varied between the two varieties (Fig. 3). Also, tuber placement depth affected the date of emergence for the two varieties. Emergence for the *true type* tubers planted at 2-inch depth was observed on April 25 compared to May 2 for the *new type* variety at the same depth. Emergence for *true type* and *new type* tubers planted at the 6-inch depth was on May 4 and May 6, respectively. Tubers planted at the 10- to 18-inch depth started to emerge in June for both varieties. The *true type* variety produced fewer tubers, ranging from 358 to 921 tubers/1,558 cubic inches of soil compared to 625 to 921 tubers for the *new type*. The highest number of tubers was produced when both varieties were planted at the 6-inch depth. The high tuber production for the *new type* could be attributed to a higher number of stems, suggesting greater ability to produce rhizomes and possible expansion to cover a wider area within a short time.

Study 3

The *new type* plants harvested on June 15 had a greater number of stems and plant height compared to the *true type* (Fig. 4). The number of stems and height peaked during late August for both the *true* and *new type* variety. The decrease in the number of stems starting early September indicated plant maturity towards the end of the season and container effects. These results suggest that the *new type* YNS is capable of forming large patches early in the season and possibly severely competing with onions compared to the *true type*. This matches field observations in locally infested fields.

Relatively higher number of stems for the *new type* resulted in greater root weight and the number of tubers produced per pot compared to the *true type* (Fig. 5). The number of tubers for the *true type* variety ranged from 28 to 744/pot for plants harvested June 15 and September 17, respectively. Respective tuber number for the *new type* variety was 112 to 718/pot. These studies will be repeated for two more years to confirm the results and complement ongoing greenhouse studies to evaluate local YNS varietal response to herbicide dose.

References

Felix, J., and J. Ishida. 2009. Yellow nutsedge tuber production in response to depth of emergence. Malheur Experiment Station Annual Report 2008. Oregon State University Special Report 1094:185-190.

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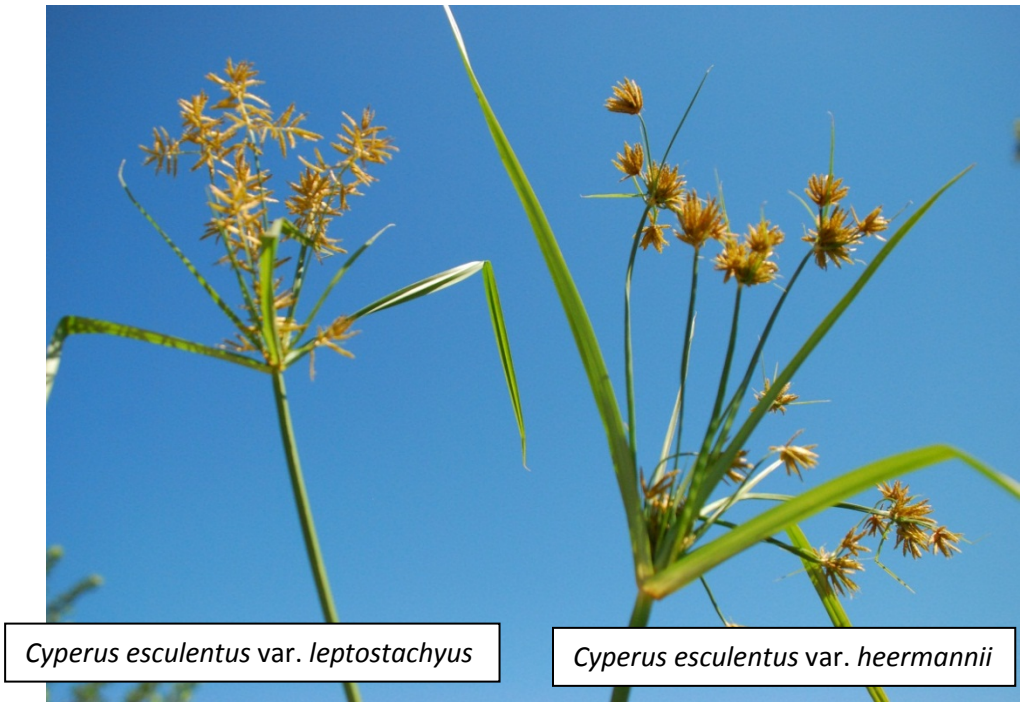

*Figure 1. Yellow nutsedge (*Cyperus esculentus*) var* leptostachyus *(top left) and var*. heermannii *(top right and bottom picture) in the Treasure Valley of eastern Oregon. Photos by Dr. Joel Felix, Oregon State University, Malheur Experiment Station, Ontario, OR.*

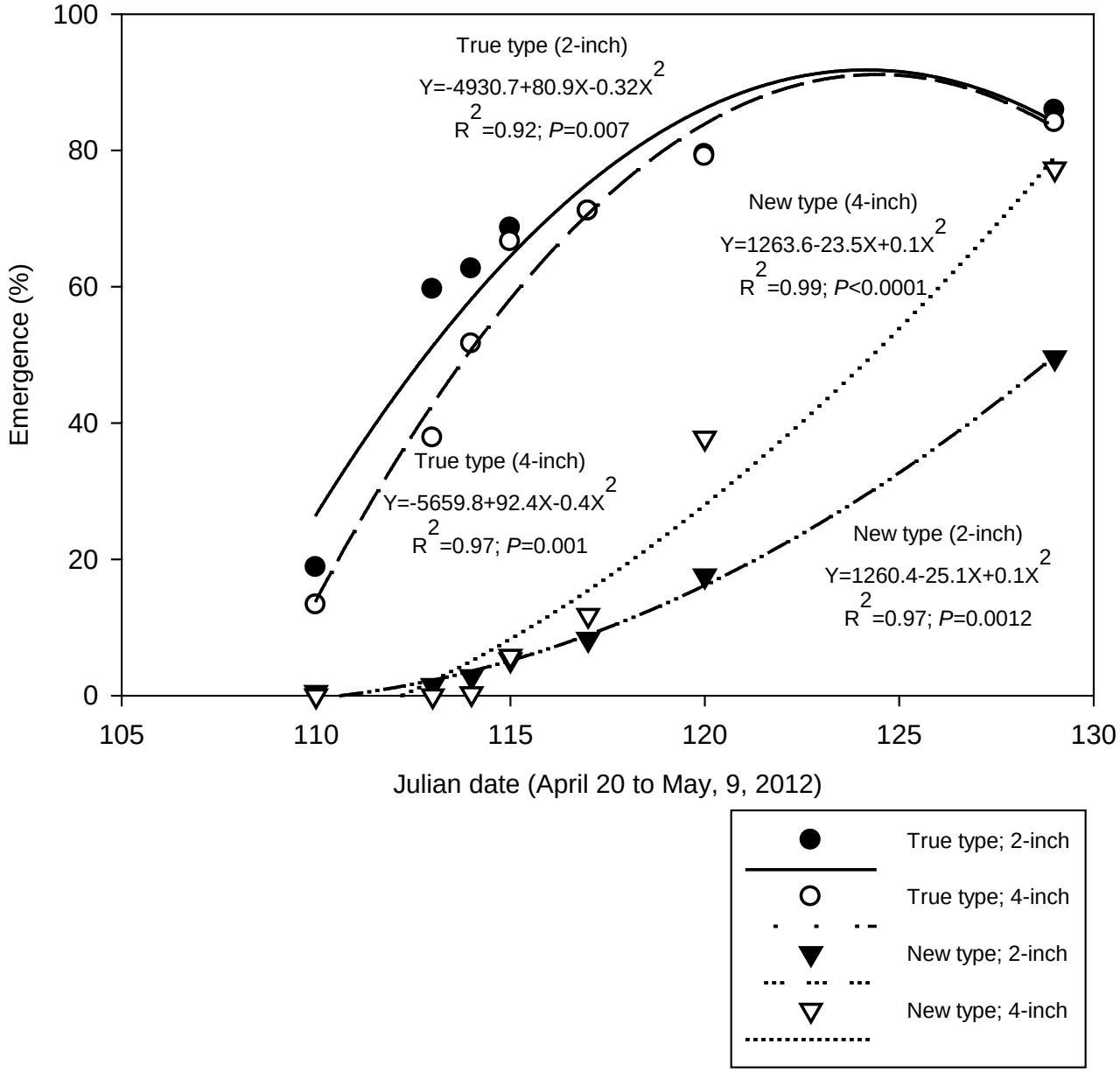

Figure 2. Yellow nutsedge emergence in response to depth of tuber placement for Cyperus esculentus *var*. leptostachyus *(true type) and* Cyperus esculentus *var*. heermannii *(new type) at the Malheur Experiment Station, Ontario, OR, 2012.*

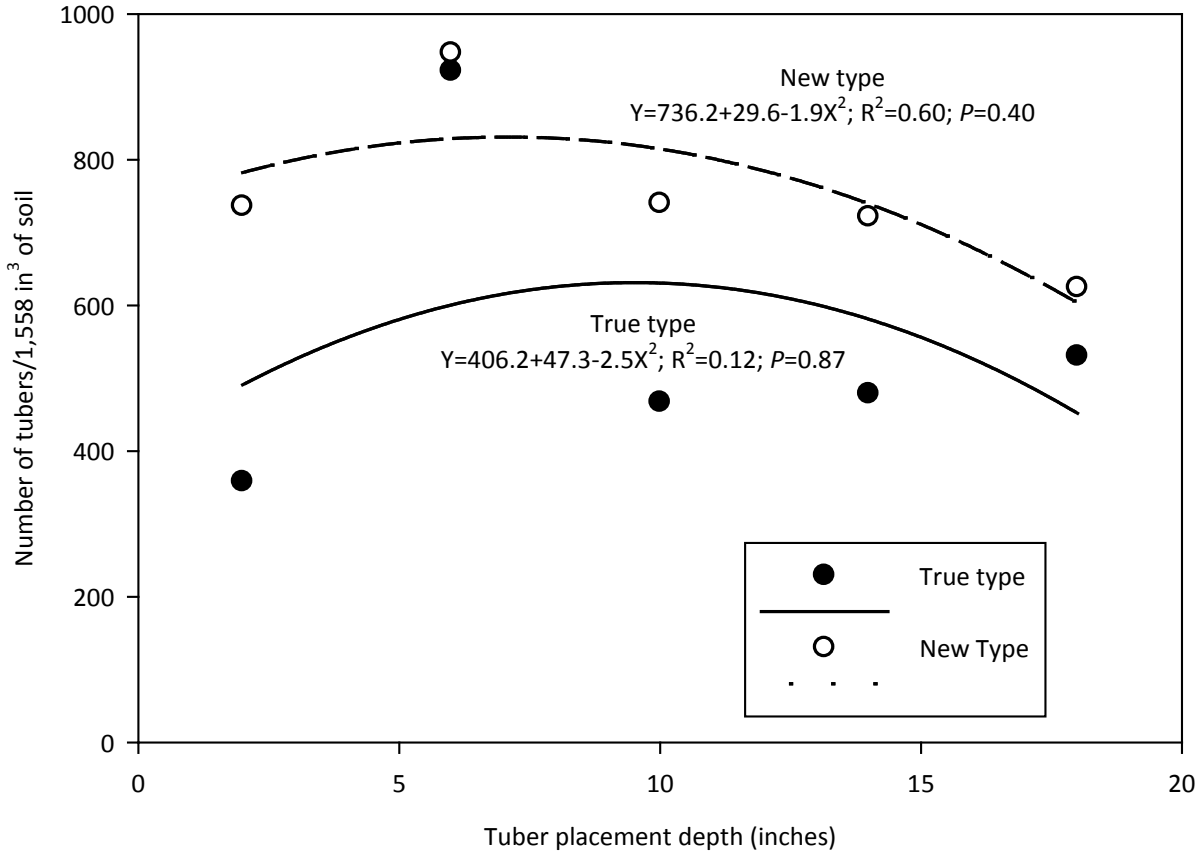

Figure 3. Tuber production in response to depth of placement for Cyperus esculentus *var.* leptostachyus *(true type) and* Cyperus esculentus *var.* heermannii *(new type) at the Malheur Experiment Station, Ontario, OR, 2012.*

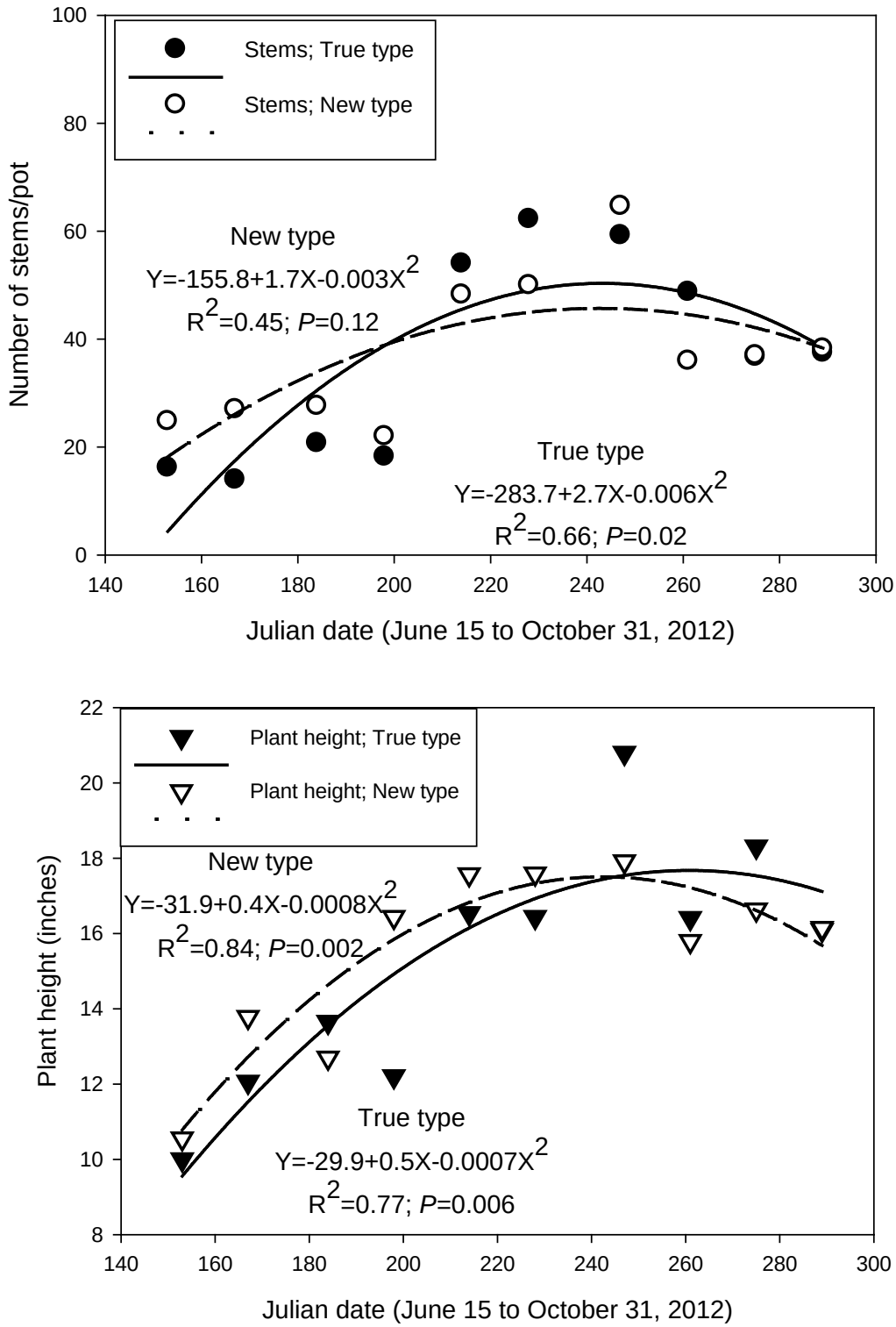

Figure 4. Yellow nutsedge number of stems and plant height for biweekly harvest of Cyperus esculentus *var.* leptostachyus *(true type) and* Cyperus esculentus *var.* heermannii *(new type) at the Malheur Experiment Station, Ontario, OR, 2012.*

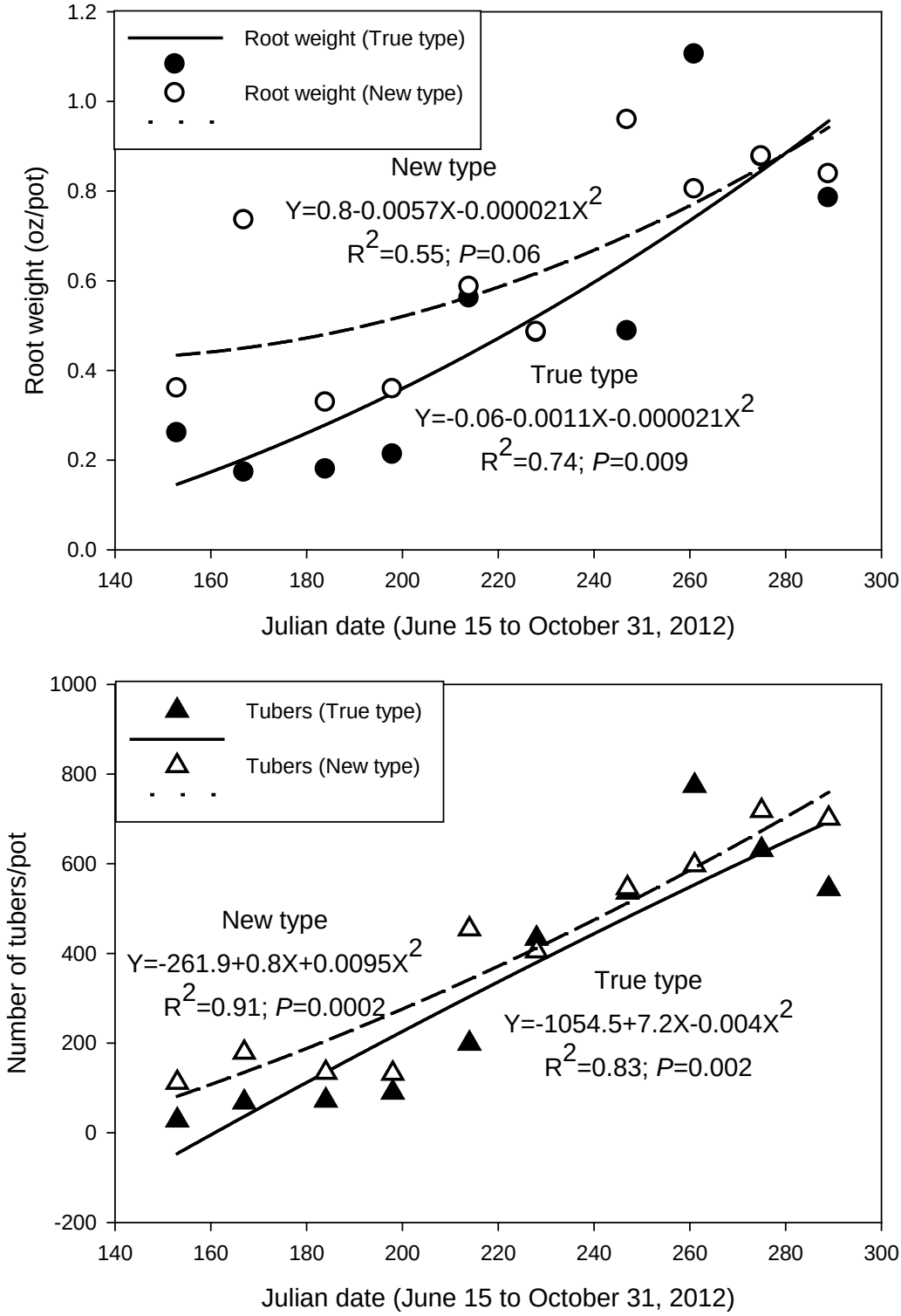

Figure 5. Total number of yellow nutsedge tubers for Cyperus esculentus *var.* leptostachyus *(true type) and* Cyperus esculentus *var.* heermannii *(new type) plants harvested biweekly at the Malheur Experiment Station, Ontario, OR, 2012.*