Reprinted from HortScience, Vol. 25(4), April 1990
A Publication of the American Society for Horticultural Science, Alexandria, Virginia

HortScience 25(4):443–445. 1990.

Rate and Time of Triclopyr Application to Control Virginia Creeper in a Peach Orchard

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Additional index words. *Parthenocissus quinquefolia,* perennial weed

Abstract. **Triclopyr was applied once or twice in consecutive years to Virginia creeper [*Parthenocissus quinquefolia* (L.) Planch.] that was growing along the ground beneath the peach [*Prunus persica* (L.) Batsch.] tree canopy. All rate (0 to 1.1 kg·ha^{-1}) and month combinations controlled Virginia creeper during the season of application. A single application of triclopyr at 1.1 kg·ha^{-1} was insufficient for control beyond 1 year. Satisfactory control of Virginia creeper was obtained with two applications of triclopyr at 1.1 kg·ha^{-1} made in either August or September. Chemical name used: [(3,5,6-trichloro-2-pyridinyl)oxy]acetic acid (triclopyr).**

Virginia creeper is a perennial vine that can be a serious weed problem in fruit tree orchards in West Virginia. It propagates vegetatively or from seed, grows 4 m/year along the ground and into tree crowns, and establishes a dense foliage that can dominate a site. A heavy infestation can shade fruit trees, compete for available nutrients and water, and reduce fruit production. In apple (*Malus* spp.) orchards, Tworkoski et al. (1988) demonstrated that the systemic herbicide triclopyr could reduce Virginia creeper infestations through the second season after treatment. Their work suggested that triclopyr rates <0.6 kg·ha^{-1} might reduce infestations and that lower rates were desirable in an orchard. Management of Virginia creeper with low rates of triclopyr could be enhanced by applying triclopyr at a time of maximum herbicide translocation or plant susceptibility. Previous work indicated that triclopyr applications in August or early September provided better Virginia creeper control than in February, May, June, or July (Tworkoski and Young, 1987; R.S.Y., unpublished data). The objectives of this experiment were to determine the effect of rate, time, and repeat application of triclopyr on Virginia creeper management. The effect of a long or a short photoperiod on triclopyr absorption and translocation was also investigated.

In a field experiment, the butoxyethyl ester of triclopyr was applied to Virginia creeper growing in plots 3 × 10 m beneath peach trees in an orchard near Kearneysville, W.Va. Triclopyr applications were made with a carrier volume of 280 liters·ha^{-1} using a spray boom equipped with two 11008 and one 0C08 TeeJet (Spraying Systems, Wheaton, Ill.) nozzle that provided uniform coverage of Virginia creeper on the ground. Adjuvant (Dow XRM-4714) concentration was constant for all herbicide applications corresponding to a commercial blank formulation of 1.1 kg·ha^{-1}. Single treatments of triclopyr at 0, 0.1, 0.3, 0.6, or 1.1 kg a.i./ha were applied to plots on 14 Aug. or 17 Sept. 1986, or 17 July, 18 Aug., or 9 Sept. 1987. The same rates of triclopyr were applied twice to another set of plots and on the same dates as the single treatments; these two applications were made in Aug. or Sept. 1986 and again in 1987. Each rate/month treatment was replicated four times, and percent ground covered by Virginia creeper and total vegetation was evaluated as the average of two visual estimates at the end of one growing season following the year of application.

Since daylength influences plant growth and development, and probably translocation within the phloem, an experiment was conducted in growth chambers to determine the

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Table 1. Percent ground area covered by Virginia creeper at the end of the growing season following the year of a single application of triclopyr.

Rate of triclopyr (kg·ha^{-1})	Time of triclopyr application				
	1986		1987		
	Aug.	Sept.	July	Aug.	Sept.
	% Ground covered[z]				
0.0	69 ± 7	71 ± 8	44 ± 8	75 ± 7	68 ± 9
0.1	6 ± 2	0	8 ± 2	4 ± 2	1 ± 1
0.3	3 ± 1	0	1 ± 1	1 ± 1	3 ± 1
0.6	1 ± 1	0	3 ± 1	0	1 ± 1
1.1	1 ± 1	0	1 ± 1	0	0

[z]Means of four replications ±SE.

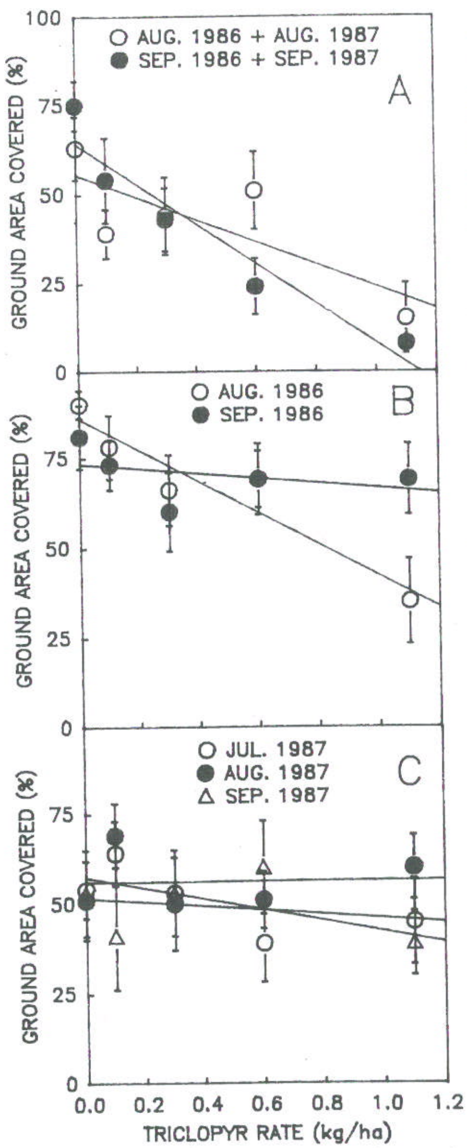

Fig. 1. Relationship between rate, time, and number of applications of triclopyr and ground area covered by Virginia creeper. (**A**) Treated once in 1986, again in 1987, and evaluated in Sept. 1988; (**B**) treated once in 1986 and evaluated in Sept. 1987; (**C**) treated once in 1987 and evaluated in Sept. 1988. Regressions were nonsignificant (NS) or significant (*) at $P = 0.05$ as follows: (**A**) Aug.: $y = 56 - 32x$ ($r^2 = 0.79$*); Sept.: $y = 64 - 56x$ ($r^2 = 0.96$*). (**B**) Aug.: $y = 86 - 44x$ ($r^2 = 0.95$*); Sept.: $y = 73 - 7x$ ($r^2 = 0.39$ NS). (**C**) July: $y = 57 - 15x$ ($r^2 = 0.71$ NS); Aug.: $y = 56 + x$ ($r^2 = 0.03$ NS); Sept.: $y = 52 - 6x$ ($r^2 = 0.28$ NS).

Table 2. Effect of photoperiod on Virginia creeper growth and triclopyr movement.

Variable measured	Photoperiod (hr)[z] 8	16
Shoot growth (cm)	4 b	11 a
Leaf area (cm^2)	21 b	33 a
Leaf chlorophyll ($mg \cdot g^{-1}$)	1.1 a	1.1 a
Leaf protein ($mg \cdot g^{-1}$)	32 a	34 a
Triclopyr distribution	*dpm*	
Treated leaf	4700 a	4500 a
Shoot	5000 a	6400 a
Root	1200 a	2200 a
Rinse	4000 a	4200 a

[z]Value is mean of 10 replications. Means within a row followed by the same letter are not significantly different at $P = 0.05$ using Student's t test.

effect of photoperiod on absorption and movement of triclopyr within Virginia creeper. To simulate conditions that likely would maximize growth or limit late-season growth, 10 2-month-old Virginia creeper seedlings (≈80 cm long) were placed in a growth chamber with either a 16- or 8-hr photoperiod (22 ± 2C, 150 $\mu mol \cdot s^{-1} \cdot m^{-2}$ photosynthetic photon flux). One week later, a single leaf on each plant received 15 droplets of 0.01 μCi (1 Ci = 37 GBq) ^{14}C-labeled triclopyr (uniformly ring labeled, specific activity 10 μCi/mmole) in 48 μl of water. One week after treatment, each plant was separated into root, shoot, and treated leaf, lyophilized, ground, and ^{14}C distribution was determined after combustion (Peterson, 1969). Treated leaves were each rinsed with 3 ml of 80% methanol at harvest to determine the amount of ^{14}C-labeled triclopyr that was not absorbed. Foliar chlorophyll and protein content were also measured to determine the progress of senescence (Arnon, 1949; Lowry et al., 1951).

In the field experiment, all rates of triclopyr significantly reduced Virginia creeper growth during the season of application (Table 1). Satisfactory control persisted through June of the following season (data not shown). However, the few Virginia creeper plants that were not killed or newly germinated grew quickly to occupy vacated space. Four of the five single triclopyr applications did not effectively control Virginia creeper when evaluated at the end of the second growing season following treatment, regardless of rate or time of application (Fig. 1 B and C). A significant reduction in Virginia creeper due to increasing rates of a single triclopyr application resulted only from the Aug. 1986 treatment. A single application of triclopyr of 1.1 $kg \cdot ha^{-1}$ or less did not provide control of Virginia creeper to the end of the second season following treatment. Previous work in an apple orchard indicated that Virginia creeper could be effectively reduced through the season following a single triclopyr treatment with rates between 0.6 and 2.2 $kg \cdot ha^{-1}$ (Tworkoski et al., 1988). The apple trees of that experiment heavily shaded the orchard floor, and the leaves of Virginia creeper were larger and darker green than those beneath the less dense peach trees of this experiment. The larger leaf area, or possibly a thinner leaf cuticle, may account for greater control of Virginia creeper by triclopyr in the apple orchard.

Satisfactory Virginia creeper control was obtained using two triclopyr applications in consecutive years (Fig. 1A). Virginia creeper rooted near a tree trunk was particularly difficult to control, since its foliage was in the tree crown and thus protected from the herbicide. Repeated annual triclopyr applications were more effective because the second application killed the few escaped plants that could have grown rapidly to dominate a site. Two annual applications of triclopyr were more effective when made in September than in August (Fig. 1A).

Reduced growth caused by a short photoperiod did not decrease uptake or alter translocation of triclopyr. Sixty-four percent less stem elongation and 36% less leaf area resulted from the 8-hr than from the 16-hr photoperiod; however, total ^{14}C-labeled triclopyr uptake and distribution were not reduced (Table 2). Senescence was not induced by the shortened photoperiod, since chlorophyll and protein concentrations remained the same. A reduced rate of growth of Virginia creeper, before senescence, will frequently occur between mid-August and mid-September. The combined results from this experiment indicate that triclopyr can be applied late in the season and achieve good translocation.

This work indicates that managing heavy infestations of Virginia creeper in peach orchards requires at least two annual applications of triclopyr. Triclopyr applications of 1.1 $kg \cdot ha^{-1}$ will provide satisfactory control of Virginia creeper the season of application; however, two annual applications are required for more lasting control. Effective control can be achieved with applications of triclopyr in August or September. Other woody plants have been killed by cutting stems near the ground and applying undiluted triclopyr to the freshly cut surface (O. Schubert, personal communication). Vines of Virginia creeper that root near trunks and then grow into crowns might also be killed by shearing and treating with triclopyr. Additional "spot" applications may be required to kill missed or newly germinated plants.

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