HIGH TEMPERATURE BOOSTS 2,4,5-T ACTIVITY IN WOODY PLANTS

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ABSTRACT. Plants of seven woody species absorbed more 2,4,5-T ester at 95° than at 55° F. In sweetgum, post oak, water oak, and bitter pecan more of the herbicide was also translocated to the roots at the higher temperature. In sumac, red maple, and loblolly pine more 2,4,5-T was moved to the roots at 55°.

Foliar sprays for brush control are usually applied when the temperature is less than 80° F. Many operators consider this temperature a maximum because losses due to evaporation and drift of low volume sprays increase at higher temperatures. In recent years, however, materials were developed that make it possible to spray at 95° or more. The study described here explored the effects of high temperature on absorption and translocation of a 2,4,5-T ester by seven common woody species.

Procedures

Fifteen 1-year-old potted seedlings of sweetgum (*Liquidambar styraciflua* L.), sumac (*Rhus glabra* L.), post oak (*Quercus stellata* Wangenh.), water oak (*Q. nigra* L.), red maple (*Acer rubrum* L.), bitter pecan (*Carya aquatica* Nutt.), and loblolly pine (*Pinus taeda* L.) were selected for uniform size. Five plants of each species were held in each of three growth chambers for 2 weeks. One chamber main-day and night temperatures of 55 and 50°; the second, 75 and 60°; and the third, 95 and 80°. Sixteen hours of light at 3,500 to 4,000 foot-candles followed by 8 hours of darkness comprised a day. After the 2-week period the foliage of each plant was treated with $\frac{1}{2}$ ml. of a solution containing 4 pounds ae in 5 gallons of the isooctyl ester of 2,4,5-T plus enough C^{14} labeled 2,4,5-T to provide 0.3 μc of activity per plant. Herbicide was placed on the leaves with a hypodermic syringe. It was applied at the beginning of a "day" period.

Plants were returned to their chambers for 96 hours. Then they were harvested, washed, and divided at the junction of the lowest branch or leaf into a root and a top section.

These sections were analyzed separately by standard extraction and liquid-scintillation counting procedures. The combined counts were considered a measure of total absorption. That from the roots was taken as downward translocation. Measurement data were analyzed statistically, and all differences reported are significant at the 5-percent level.

Results and Discussion

All seven species absorbed more 2,4,5-T ester at 95 than at 55° (table 1). In sweetgum and sumac, species that have low resistance to 2,4,5-T esters, absorption was lowest at 55, higher at 75, and highest at 95°. In water oak, which is moderately resistant, uptake was much greater at 75 than 55°, but about the same at 95 as at 75°. In post oak, which is also moderately resistant, and in highly resistant bitter pecan, red maple, and loblolly pine there was little or no difference in absorption at 55 and 75°, but absorption was much higher at 95°.

Table 1.--*Absorption of C^{14} labeled 2,4,5-T ester by seven woody species 96 hours after foliar spraying*

Species	Temperature		
	55° F.	75° F.	95° F.
	- - - - - - *Counts per minute* - - - - - -		
Sweetgum	1/ 65,670a	77,197b	100,652c
Sumac	45,046a	57,281b	82,797c
Post oak	73,741a	84,262a	124,953b
Water oak	70,032a	134,473b	134,330b
Red maple	74,597a	80,616a	155,068b
Bitter pecan	65,409a	58,664a	151,649b
Loblolly pine	83,522a	91,745a	143,553b

1/ For a given species, values followed by the same letter do not differ significantly at the 5-percent level.

Hammerton (*1*) found that rises in temperature are likely to increase the susceptibility of weeds to applied herbicides until superoptimal temperatures cause wilting, stomatal closure, and rapid desiccation of spray droplets. Superoptimal temperatures have not been defined, but they are likely to vary with humidity, soil moisture, plant species, and droplet size and composition.

Morton (*2*) found that more 2,4,5-T was absorbed by mesquite seedlings at 100 than at 70 or 85°. He also found, however, that at 70° translocation in the plants was toward the roots while at 85 and 100° it was toward actively growing tops. In the study reported here, only downward translocation was measured. In post oak, water oak, and bitter pecan, translocation to roots was greatest at the highest temperature (95°). In sweetgum, movement to roots at 95° equalled that at 75°, and both were higher than movement at 55° (table 2). In sumac, red maple, and loblolly pine the greatest herbicide content of the roots was found at the lowest temperature. In five of the seven species translocation to roots at 75° was either lowest or not significantly greater than the lowest value. At this temperature, top growth may have been fastest. Growth of woody plants in the South is normally lower in the hot summer months than in the cooler spring months. Because of high physiologic activity in tops at 75°, herbicide may have tended to concentrate there rather than in roots. In sweetgum and post oak the lowest 2,4,5-T levels in the roots were found at 55°, and concentrations increased with each rise in temperature.

Table 2.--*Amount of C^{14} labeled 2,4,5-T ester found in roots of seven woody species 96 hours after foliar spraying*

Species	Temperature		
	55° F.	75° F.	95° F.
	Counts per minute		
Sweetgum	1/ 243a	825b	847b
Sumac	992b	203a	708b
Post oak	581a	936b	1,671c
Water oak	1,587b	281a	3,051c
Red maple	515b	125a	179a
Bitter pecan	199a	79a	645b
Loblolly pine	1,776c	246a	615b

1/ For a given species, values followed by the same letter do not differ significantly at the 5-percent level.

High absorption in all seven species and high translocation in five of six hardwood species indicate that foliar spraying at high temperatures may be effective if certain detrimental conditions are overcome. High temperatures are normally associated with low relative humidity and increased air movement. These conditions make spray placement difficult, desiccate spray droplets, and vaporize ester formulations of herbicide. These difficulties are not insurmountable, however. Nonvolatile herbicides are available, as are slow-drying formulations. These materials can be sprayed in droplets heavy enough to permit placement in a light to moderate wind if field tests show that effectiveness is increased by spraying when the temperature is as high as 95°.

Literature Cited

1. Hammerton, J. L. 1967. Environmental factors and susceptibility to herbicides. Weeds 15:330-336.

2. Morton, H. L. 1961. Absorption and translocation of 2,4,5-T by mesquite seedlings as influenced by temperature and relative humidity. South. Weed Conf. Proc. 14:325.