Comparison of Chopped Newspaper with Microfoam for Winter Protection of Container-grown Nursery Stock

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Additional index words. overwintering, winter injury, shredded newspaper

Summary. Chopped newspaper at 3.5 and 7.0 kg·m^{-2} enclosed in white polyethylene sheeting or enclosed in nylon netting at 3.5 kg·m^{-2} was compared with two layers of 0.64-cm microfoam as winter covering of four taxa of container-grown nursery plants. White polyethylene-enclosed newspaper moderated winter temperatures more than net-enclosed newspaper or two layers of microfoam under white polyethylene. All coverings provided protection against winter injury, as evidenced by container temperature, but net-enclosed newspaper at 3.5 kg·m^{-2} resulted in a minimal percentage of *Daphne burkwoodii* 'Carol Mackie' plants with three or more shoots longer than 2 cm in the spring. *Gaillardia grandiflora,* covered by newspaper during winter, had less spring growth than plants covered by microfoam, but all coverings provided protection for *Juniperus horizontalis* 'Prince of Wales' and *Physostegia virginiana.*

Overwintering is one of the most limiting factors for growing nursery plants in containers in northern climates. Studies in Massachusetts showed that roots of many container-grown plants are injured at temperatures between –5 and –20C during winter (Havis, 1976).

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Microfoam covered with 4-mil white polyethylene sheeting has been effective for overwintering container-grown nursery plants in Vermont (Pellett et al., 1985) and is used commonly in the nursery trade. However, microfoam is non-biodegradable, difficult to store or reuse, and eventually ends up in landfills.

Newspaper is available in shredded or in chopped, irregularly shaped pieces, most ranging in size from 1 to 12 cm^2. Chopped newspaper is used commonly as livestock bedding in some areas of the United States (Temple, 1990), and is available at prices competitive with straw (Munn, 1992). Newspaper used as a winter cover could be composted or reused as a weed-control mulch in cultivated row crops (Munn, 1992).

The purpose of our experiments was to compare chopped newspaper with microfoam as a winter protective covering for container-grown nursery stock. For 2 years, we compared the effectiveness of several different covering treatments of newspaper to two layers of 0.64-cm (1/4-inch) -thick microfoam covered by one sheet of 4-mil white polyethylene sheeting. We compared white polyethylene sheeting with nylon netting as enclosures for holding the newspaper in place. Experiments were carried out at the Univ. of Vermont Horticultural Research Center, South Burlington.

Materials and methods

These studies were conducted during Winter and Spring 1990-91 and 199 1–92. Five taxa of container-grown plants were covered the first winter and four the second winter, representing both woody and herbaceous perennials. Recorded minimum temperatures of the growing medium during the first winter revealed that 2.75 kg·m^{-2} polyethylene-covered newspaper resulted in better temperature moderation than 2.75 and 5.5 kg·m^{-2} of net-covered paper. Therefore, only one treatment of net-covered paper was compared with polyethylene-covered paper during the second winter to allow more plants per treatment. Container media temperature patterns among treatments during the first winter were similar to those during the second winter; therefore, only data from the second year are presented.

Container-grown plants of four taxa were spaced container-to-container in each of five treatments within two blocks. Treatments were randomized within each block. Each treatment contained 20 plants each of *Juniperus horizontalis* 'Prince of Wales', *Physostegia virginiana* 'Crown of Snow', *Gaillardia grandiflora* 'Goblin', and 40 plants of *Daphne burkwoodii* 'Carol Mackie'. Containers with *Daphne* were laid on their side to prevent stem breakage by covering treatments. *Junipevus* were in 1800-cm^3 (15-cm-diameter) black polyethylene containers and the other three species were in 850-cm^3 (11.7-cm-diameter) black polyethylene containers. A guard row of 850-cm^3 containers with soil were placed on the perimeter of each plot.

Physostegia and *Gaillardia* were grown from seed during the previous summer. *Daphne* were rooted from softwood cuttings taken in June, and *Juniperus* were 3-year-old plants from cuttings. Plants were grown in a medium of sphagnum peat, vermiculite, and perlite (Pro-Mix BX, Premier Brands, Yonkers, N.Y.).

Cover treatments were applied 21 Nov. 1991 and removed 10 Apr. 1992—dates that approximate those used by local nurseries. They were: 1) no cover; 2) newspaper, 3.5 kg·m^{-2} (6.5 lb/yd^2, ≈6 inches deep) between two pieces of nylon netting (7/8-inch mesh); 3) newspaper, 3.5 kg·m^{-2} (6.5 lb/yd^2) between two pieces of white polyethylene sheeting (4-roil); 4) newspaper, 7 kg·m^{-2} (13lb/yd2, ≈10 inches deep) between polyethylene sheeting as in treatment 3; and 5) two layers of 0.64-cm microfoam covered with white polyethylene sheeting (4-roil). Two layers of microfoam were used, because one layer has resulted in container media temperatures low enough to cause injury to many plant species (Pellett et al., 1985). White polyethylene sheeting was used to reflect light, therefore reducing heat buildup under covers. Soil was used to secure the edges of the covers to the ground.

A copper–constantan thermocouple was placed in the center of growing media in one 11.7-cm container for each treatment near the middle of each block and a thermocouple was placed in air space between adjacent containers. Container and air temperatures of each treatment were averaged for two blocks. Temperatures were recorded by a multipoint

Honeywell Recorder (Honeywell, Fort Washington, Pa.) four times daily at 0630, 1330, 1730, and 2400 HR.

The plants were evaluated for winter injury on 13 May 1992. The percentage of plants with new shoot growth (percentage alive) and percentage with vigorous new shoot growth (three or more shoots >2 cm long) were determined.

Results and discussion

We observed two critical periods when container-grown nursery plants might be damaged during the overwintering process (Pellett et al., 1985)—during midwinter, when the container media temperatures might fall below the critical point for root survival, or spring, when air temperatures can get high enough under protective covers to stimulate stem growth. New growth might be injured during subsequent freezing air temperatures when the plants have been uncovered.

Polyethylene-enclosed newspaper at 3.5 and 7 kg·m^{-2} resulted in better protection from low temperatures than the net-enclosed paper or microfoam during January (Fig. 1). Media temperatures under 3.5 kg·m^{-2} polyethylene-enclosed and net-enclosed paper reached a minimum of –2 and –10C, respectively, at 0630 HR on 27 Jan. 1992.

Increasing the newspaper under polyethylene from 3.5 to 7 kg·m^{-2} provided only slightly higher container media. temperatures during declining ambient temperatures. Temperatures of container medium under the higher and lower rates of polyethylene-enclosed newspaper were –1 and –2C respectively, at 0630 HR on 27 Jan. 1992, when the ambient temperature declined to –18C. Temperatures under the polyethylene- and net-enclosed newspaper (3.5 kg·m^{-2}) were -2 and -10C, respectively. Temperatures under the microfoam ranged from 3 to 5C colder during 25 to 27 Jan. than under either rate of polyethylene-enclosed newspaper. These temperature patterns are representative of other dates during January and February, when ambient temperatures were below –18C.

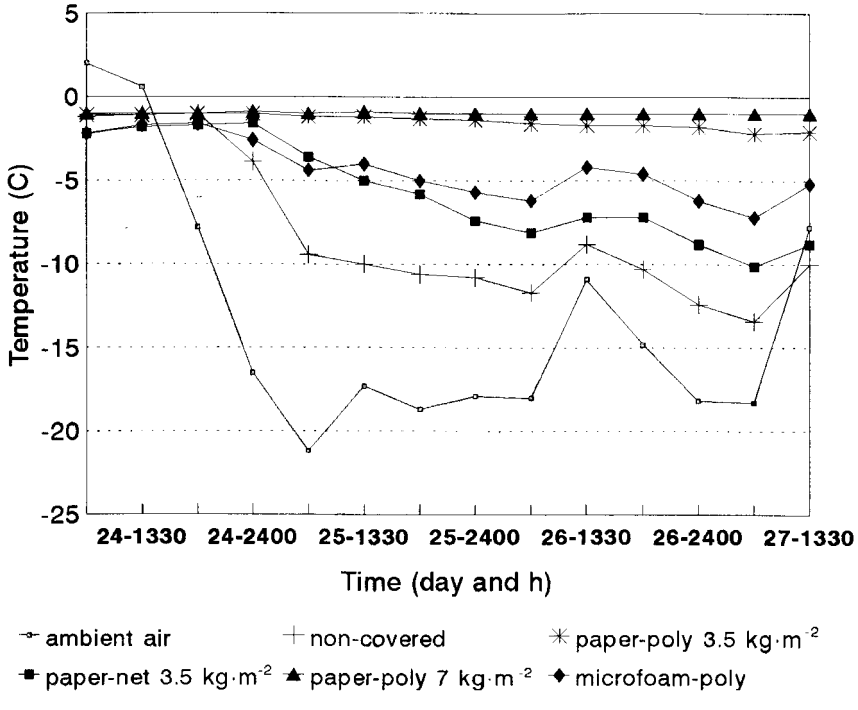

Fig. 1. ***Effect of cover treatments on daily container media temperatures at 0630, 1330, 1730, and 2400 HR, Jan. 1992.***

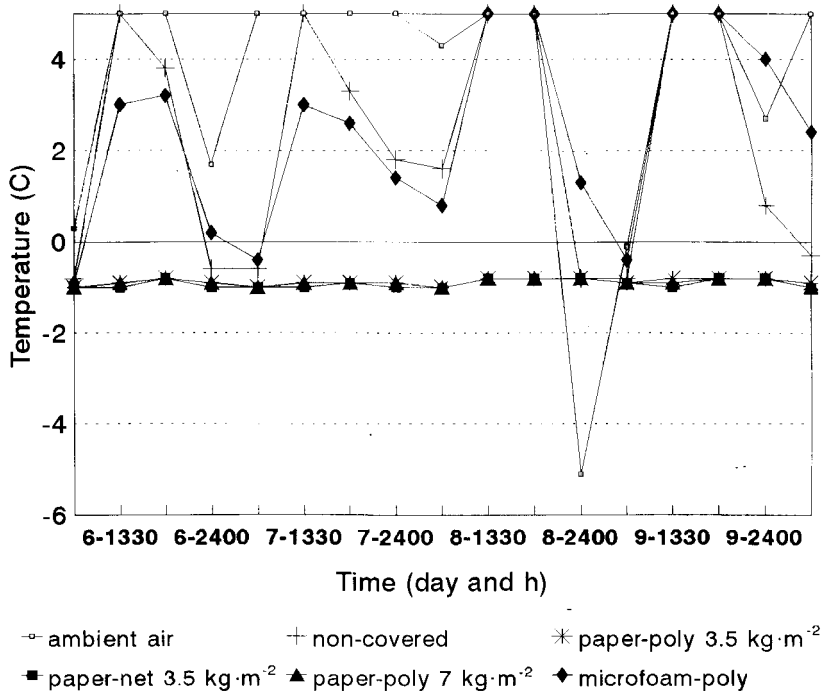

Fig. 2. *Effect of cover treatments on daily container media temperatures at 0630,1330, 1730, and 2400 HR, Apr. 1992. Temperatures shown at 5C were > 5C. Higher temperatures were not recorded.*

Temperatures in microfoam-covered containers and noncovered containers had greater daily fluctuation than newspaper-covered containers during Apr. 1992 (Fig. 2). Newspaper-covered containers were the only treatments with frozen growing media on 10 Apr., when the covers were removed. Microfoam-covered plants exhibited new shoot growth at this time. Treatments that maintain the growing medium in a frozen condition later in the spring would be expected to slow new shoot growth, thereby reducing the chance of freeze injury when uncovered in the spring.

Juniperus plants in all treatments had new growth with no visible freeze injury when evaluated in May (data not shown). The percentages of living *Daphne, Gaillardia,* and Physostegia in May were greater for covered than for noncovered plants. Percentages of living plants were not different for chopped newspaper enclosed in polyethylene or

Table 1. *Comparison of plant growth on 13 May 1992 in response to overwintering treatment.*

Taxa	Treatment	Living plants (%)	Percent with vigorous shoot growth[z]
Daphne	Noncovered	6[y]	0
	Paper–net 3.5 kg•m^{-2}	38	9
	Paper-poly 3.5 kg•m^{-2}	80	51
	Paper-poly 7.0 kg•m^{-2}	89	56
	Microfoam–poly	88	70
	$LSD_{0.05}$	19	15
Gaillardia	Noncovered	8[x]	3
	Paper–net 3.5 kg•m^{-2}	98	70
	Paper–poly 3.5 kg•m^{-2}	95	63
	Paper–poly 7.0 kg•m^{-2}	88	48
	Microfoam–poly	100	98
	$LSD_{0.05}$	13	26
Physostegia	Noncovered	28[x]	15
	Paper–net 3.5 kg•m^{-2}	100	93
	Paper–poly 3.5 kg•m^{-2}	100	90
	Paper–poly 7.0 kg•m^{-2}	100	93
	Microfoam–poly	100	93
	$LSD_{0.05}$	9	13

[z]*Percent of plants with three or more shoots longer than 2 cm*
[y]*Means of 80 plants.*
[x]*Means of 40 plants.*

microfoam covered with polyethylene (Table 1). Percentages of Gaillardia and *Physostegia* plants with vigorous spring growth for the newspaper-covered treatments were not different; however, *Gaillardia* covered by microfoam had a greater percentage of plants with vigorous shoot growth than all newspaper-covered treatments (Table 1). Daphne covered with microfoam had a greater percentage of plants with vigorous shoot growth compared to plants covered with the low rate of newspaper. *Daphne* covered with net-enclosed newspaper exhibited more winter injury than plants under other covers. Only 38% of *Daphne* plants under net-enclosed newspaper were living in the spring.

Our data indicate that chopped newspaper and microfoam provided protection against winter injury for container-grown *Daphne burkwoodii* 'Carol Mackie', *Gaillardia grandiflora* 'Goblin', and *Physostegia virginiana* 'Crown of Snow'. Chopped newspaper enclosed in white polyethylene moderated winter temperatures more than net-enclosed newspaper or two layers of microfoam under white polyethylene. Net-enclosed newspaper at 3.5 kg·m^{-2} resulted in a minimal percentage of Daphne plants with three or more shoots longer than 2 cm in the spring; however, newspaper rates higher than 3.5 kg·m^{-2} (15 cm deep) appeared to offer no increased protection when enclosed in white polyethylene. *Daphne* and *Physostegia* plants covered with microfoam and white polyethylene or 7 kg·m^{-2} chopped newspaper with white polyethylene cover had a similar percentage of plants with three or more shoots longer than 2 cm in the spring.

Those considering using chopped newspaper should realize that it is lightweight and should be applied when wind is calm. Also, the newspaper absorbed moisture during the winter, which made spring removal difficult because of the weight of wet newspaper.

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Rowcovers Improve Sweetpotato Transplant Production in Field Beds and Hotbeds

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Additional index words. bed covers, *Ipomoea batatas*, greenhouse, plastic mulch, plasticulture, vegetables

Summary. Transparent polyethylene is used to enhance sweetpotato *[Ipomoea batatas* (L.) Lam.] transplant production in hotbeds and unheated field beds. Black plastic is used also in unheated field beds. The use of these bed covers, however, frequently results in transplant damage due to overheating. Despite the positive results obtained by using rowcovers in sweetpotato transplant production, recommendations for their use are not included in extension publications. Successful adoption of rowcovers by sweetpotato transplant producers in Alabama is illustrated.

Sweetpotato transplants are produced in hotbeds and unheated field beds. Wood-frame structures, heated by water circulating in underground pipes or electric heating coils (Poole, 1962), are used for early season transplant production in the cool spring climate of northern Alabama. These A-frame structures are ≈100 ft long and 10 ft wide. The height at the sides and at the center are =1.5 and 10 ft, respectively. A transparent polyethylene cover is used to retain heat and provide frost protection for transplants in both production

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