Assessment of Wetting Agents for Use in Nurseries

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Techniques for rapid evaluation of the short-term effectiveness of wetting agents and their longevity in nursery situations are described and authenticated. Propagation media need contain no more than 0.1 ml/liter of the most effective wetting agents tested.

INTRODUCTION

Wetting agents have been used to improve the wettability of water-repellent soils since the 1960s (Letey et al., 1962). Their use in potting media stems from reports by Sheldrake and Matkin (1971) and Airhart et al. (1978, 1980).

Reeker (1954) and Sheldrake and Matkin (1971) described methods for evaluating wettability involving a measurement of the time taken for dried peat placed on the surface of pure water in a beaker to become fully wet. An end point is difficult to gauge when bark is used as the test medium, so another method of evaluation was developed by M.J. Whitehouse and S.A. Lacey for inclusion in the Australian Standard for Potting Mixes (Standards Australia, 1989).

There do not appear to be any published reports of evaluations of the longevity of wetting agents under typical nursery conditions. This paper presents a rapid method for assessing longevity and two methods for evaluating a new wetting agent.

METHODS AND RESULTS

Experiment 1: Long-Term Effectiveness in Pots. Long-term effectiveness in pots was assessed with a bark/peat/sand (7 : 2 : 1, by volume) mix of known poor wettability. It was amended with wetting agents at 0.1, 0.2, 0.4, 0.8, and 1.2 ml concentrate per liter of mix. After moistening to the water content commonly found in bagged potting mix, part of the mix of each treatment was filled into 140-mm standard pots. There were four pots of each treatment housed on mesh-topped benches in a glasshouse. One *Petunia* 'Plum Tart' plug was transplanted into each pot. They were fed weekly with a nutrient solution containing all major nutrients, with N at 250 mg/liter.

At 21 weeks and 8 months after adding the wetting agents, the rewettability of the mix in the pots was assessed as follows.

The pots were dunked for 10 min and returned to the mesh-topped bench to drain. Each pot was weighed (giving "dunked weight" = container capacity) and then returned to the bench. The potting mix in the pots was allowed to dry until the plants were totally wilted. The pots were again weighed ("dry weight"), returned to the bench, and 500 ml water slowly poured onto each pot. On completion of drainage, the pots were again weighed ("wet weight"). The water retained by the mix after pour-on, relative to that in the mix following dunking [(wet weight - dry weight)/(dunked weight - dry weight)], is a measure of the effectiveness of the wetting agent in the mix.

The results (Table 1) show considerable differences between the wetting agents, with only two giving significantly better wetting than control at 8 months.

Table 1. Water retained by potting mixes treated with wetting agents following pouring water onto dry mix in pots, as a proportion of the amount retained following dunking. Data were obtained after 21 weeks in pots planted with *Petunia* 'Plum Tart'.

Wetting agent	Concentration of wetting agent in the mix before drying (ml/l mix) 0.1	0.2	0.4	0.8	1.2
	21 weeks after planting				
Aquasoil Wetter	0.32 c	0.39 c	0.53 b	0.61 a	0.68 a
Wetta Soil	0.38 c	0.44 bc	0.50 b	0.61 a	0.68 a
Hydraflo Liquid	—	0.21 d	0.21 d	0.40 c	0.52 b
Hydraflo 15G[1]	0.28 cd	0.39 c	0.45 bc	0.60 a	0.67 a
Soil Wetter	—	0.25 d	0.25 d	0.40 c	0.51 b
Agral 600	0.22 d	0.25 d	0.35 c	0.43 bc	—
Control	0.18 d				
	8 months after planting[2]				
Aquasoil Wetter	0.21 d	0.25 cd	0.33 c	0.65 a	0.67 a
Wetta Soil	0.19 d	0.21 cd	0.31 c	0.46 b	0.53 b
Control	0.14 e				

[1] Added on the basis of the solid containing 15% wetting agent.
[2] Treatments other than those listed were not significantly different from control. Numbers followed by the same letter are not significantly different with a probability of 95%.

Sources of wetting agents evaluated: Agral 600: ICI Melbourne, Vic.; Aquasoil Wetter: Chemtech Industries, Canning Vale, Western Australia; Betta Wetta: Chemspray, Sydney, NSW; Hydraflo: Sierra Australia, Castle Hill, NSW; Multicrop Soil Wetter: Multicrop, Bayswater Vic.; Soil Wetter: Nu Erth, Meadows, South Australia; Wetta Soil: Wetta Chem Products, Bunbury, Western Australia.

Experiment 2: Effects of Long-Term Moist Storage. The other part of the media used in Expt. 1 was filled into plastic bags, which were stored in a glasshouse.

The wettability of the mixes was assessed by the Australian Standard technique within a week of wetting agent addition and again at 21 weeks and 8 months.

Moist mix was filled in quadruplicate into plastic dishes, each holding 100 ml of mix. The dishes of mix were dried to constant weight at 40°C. Identical hollows were pressed into the surface of mix in each dish using a 60 watt light globe. Ten ml of

deionized water was poured into each hollow and the time in seconds taken for it to soak in was recorded.

The wetting agents generally improved the initial wettability of the mix (Fig. 1a), but there was a wide range of effectiveness. The results of assessments at 21 weeks and 8 months (Fig. 1b and Table 2) show broadly similar trends to those found in Expt. 1 indicating that this technique gives a valid assessment of what happens in containers.

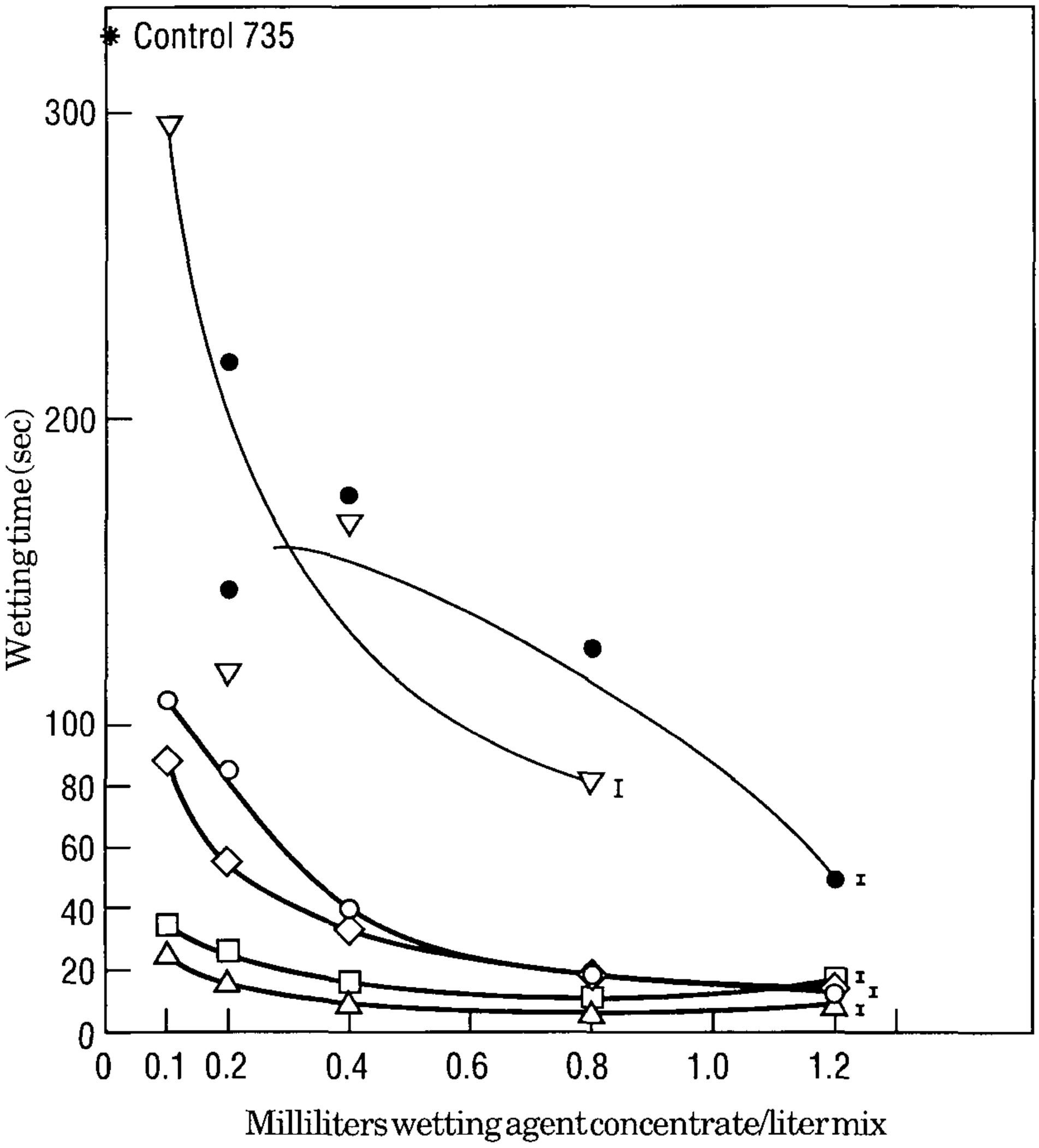

Figure 1a. Wetting time of a potting mix to which had been added 5 wetting agents. Soon after addition. The bars represent standard errors of the means for all points on a curve. □ Aquasoil Wetter; △ Wetta Soil; ▽ Agral; ◇ Hydraflo Liquid; ● Soil Wetter; ○ Hydraflo 15G.

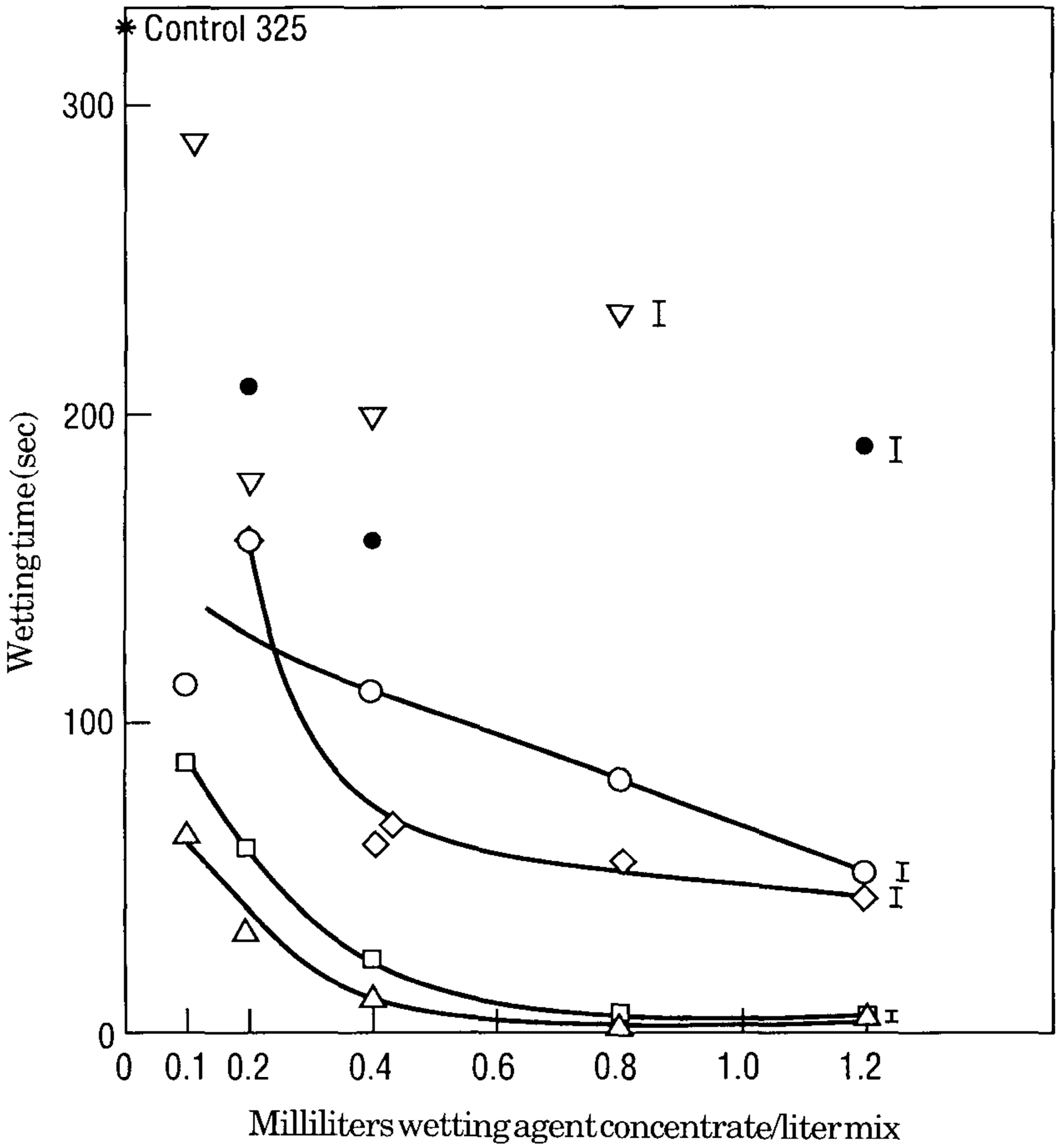

Figure 1b. Wetting time of a potting mix to which had been added 5 wetting agents. After 21 weeks of incubation. The bars represent standard errors of the means for all points on a curve. □ Aquasoil Wetter; △ Wetta Soil; ▽ Agral; ◇ Hydraflo Liquid; ● Soil Wetter; ○ Hydraflo 15G.

Table 2. Standard wettability (seconds) of potting mixes containing wetting agents, after storage moist in bags for 8 months[1].

	Wetting agent addition rate (ml/l mix)				
Wetting agent	0.1	0.2	0.4	0.8	1.2
Aquasoil Wetter	174 a	145 b	55 d	45 de	33 e
Wetta Soil	180 a	158 b	104 c	54 d	55 d
Control	197 a				

[1] Wetting times for mix samples containing Soil Wetter, Agral 600, Hydraflo Liquid and Hydraflo 15G were not significantly different from that for control mix.

Experiment 3: Evaluation by Pouring Dilute Solutions onto Dry Mix in Pots. The potting mix used for this experiment was that used for Expt. 1 and 2, but recycled after use in assessing dishwashing detergents, which were found to completely biodegrade within 14 days. The mix was dried to constant weight at 40°C. Samples, each of 325 ml, were filled into 100- mm squat nursery pots. The pots were placed on a greenhouse bench with a mesh top.

Onto the surface of the mix in each pot was slowly poured 300 ml of either deionized water (control) or solutions containing 1, 1.5, 2, or 3 ml of wetting agent concentrate per liter of solution. There were four pots of each treatment. The pots were allowed to drain for 30 min and then weighed.

All wetting agents increased the amount of water retained in the mix (Fig. 2). Retention generally increased with increases in the concentration of wetting agent in the water. There were marked differences between wetting agents, with the best allowing three times the retention of water given by the worst. The general ranking in effectiveness was similar to that found in Expt. 1 and 2.

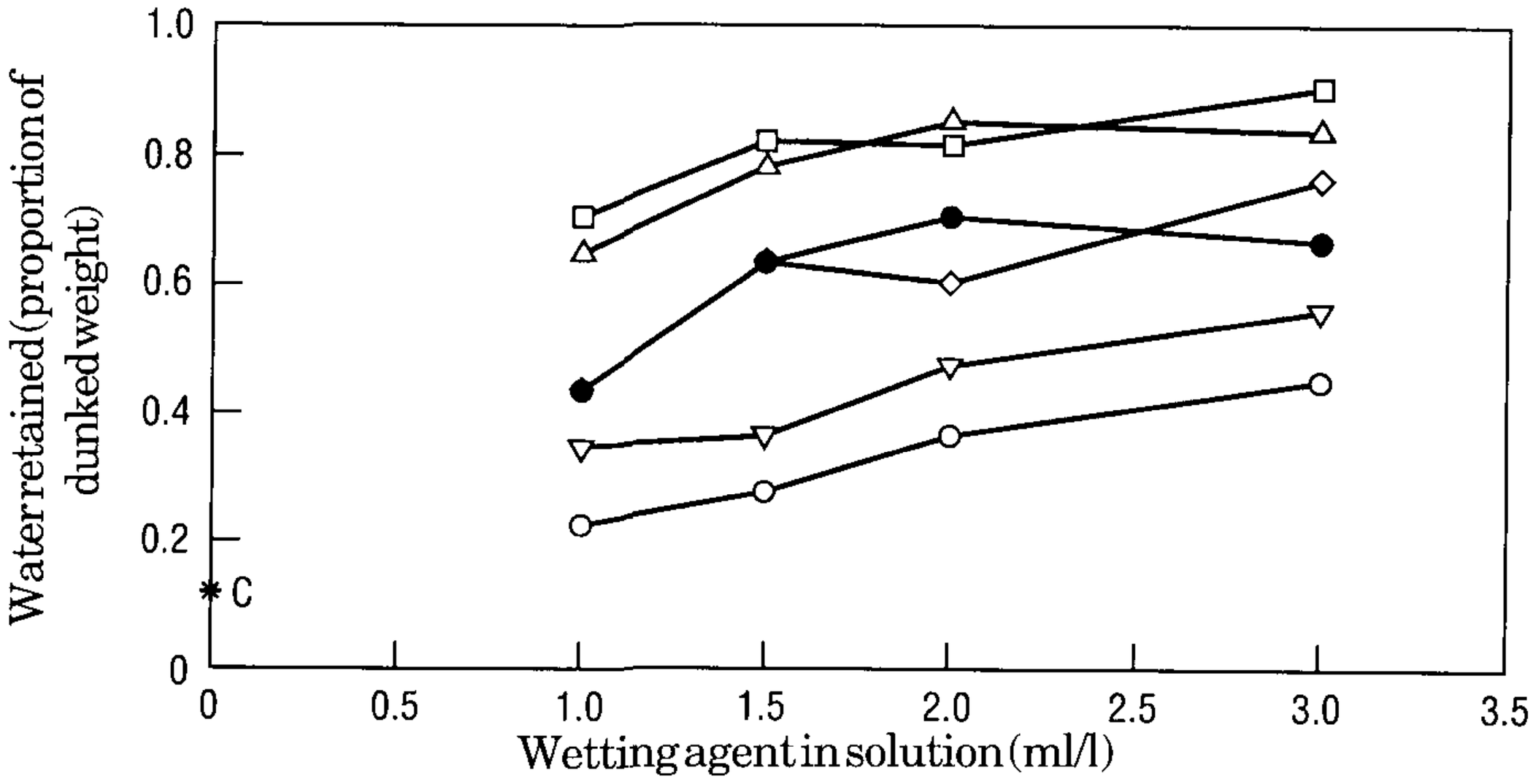

Figure 2. Retention of wetting agent solution poured onto the surface of dry potting mix, as a proportion of retention of water following dunking in water and draining. The bars represent standard errors of the means for all points on a curve. □ Aquasoil Wetter; △ Wetta Soil; ▽ Agral; ◇ Hydraflo Liquid; ● Soil Wetter; ○ Trix; C = control.

Some of the pots of mix were kept moist for 3 weeks, then dried to constant weight at 40°C and returned to the greenhouse bench. Deionized water (300 ml) was slowly poured onto each pot. They were weighed after 30 min drainage. The results are presented in Fig. 3.

All mixes containing wetting agents other than Trix dishwashing liquid were wetter at the end of drainage than was the control mix. The mixes containing Aquasoil Wetter and Wetta Soil retained considerably more water than did all other mixes.

Experiment 4: Change in Effectiveness During Short-Term Incubation. The same mix as was used in Expt. 3 was amended with wetting agents at 0.6 ml concentrate per liter. After thorough mixing, part of the mix of each treatment was immediately removed for evaluation of its wettability by the procedure of the

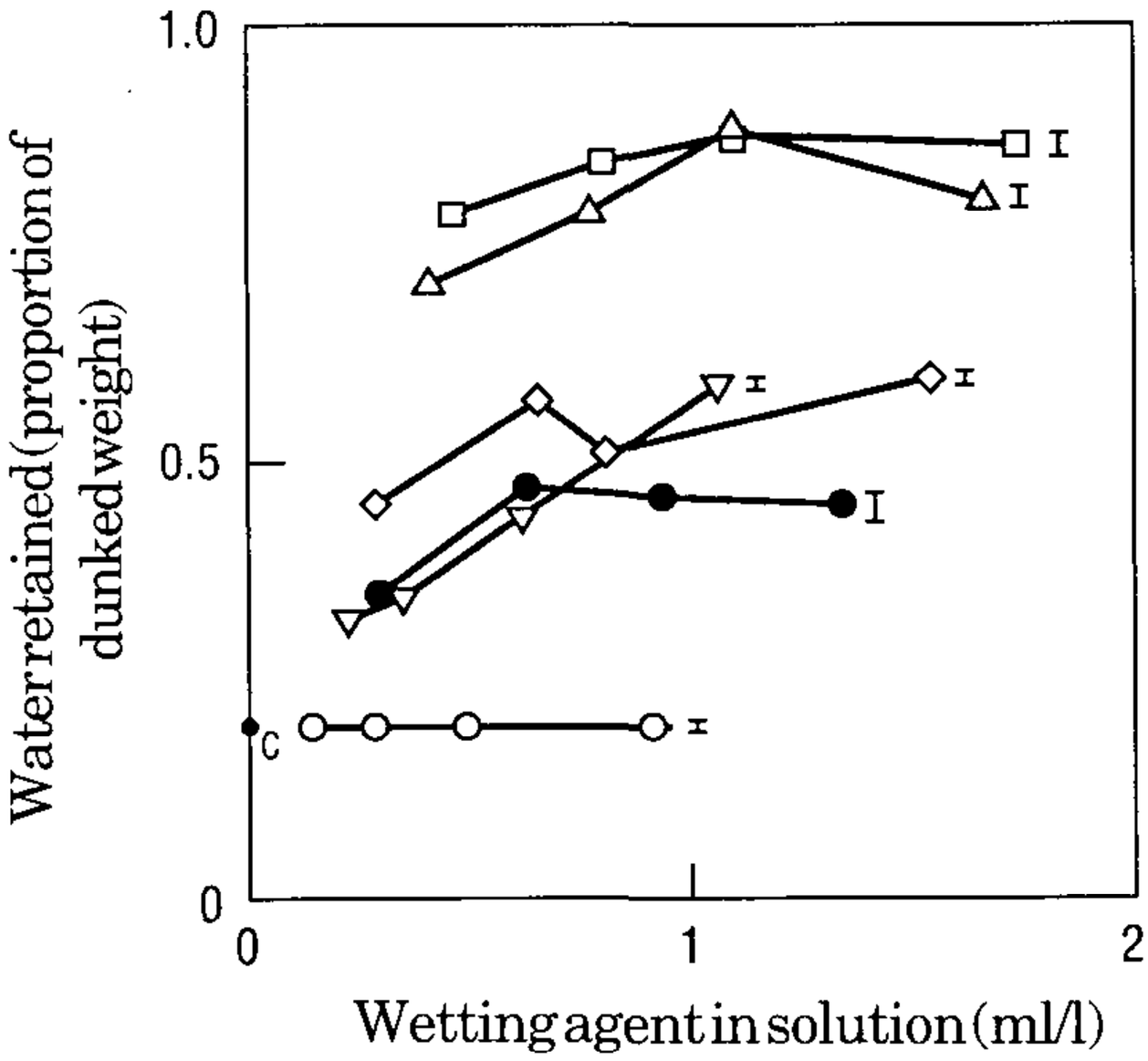

Figure 3. Retention of water poured onto the surface of dry potting mix containing various wetting agents, as a proportion of retention following dunking in water and draining. The bars represent standard errors of the means for all points on a curve. □ Aquasoil Wetter; △ Wetta Soil; ▽ Agral; ◇ Hydraflo Liquid; ● Soil Wetter; ○ Trix; C = control.

Australian Standard. The results (Table 3, first column of data) show that all wetting agents improved wettability relative to the control mix. The ranking of the wetting agents was similar to that obtained with the pour-on technique (Figs. 2 and 3).

Table 3. Effect of incubation time on the wettability of a potting mix to which had been added various wetting agents at 0.6 ml concentrate per liter of mix. Wettability figures are in seconds needed to wet the mix under standard conditions.

	Days of incubation				
Treatment	0	4	8	16	30
Wetta Soil	3 de	3 de	3 de	6 bcd	14 b
Aquasoil Wetter	5 bcd	4 cde	4 cde	6 bcd	16 b
Hydraflo 15G[1]	7 bcd	5.5 bcd	7.5 bcd	12 bc	28 ab
Multicrop Soil Wetter	8 bc	8 bc	8 bc	24 ab	31 ab
Hydraflo Liquid	10 bc	10 bc	16 b	26 ab	36 a
Agral 600	10 bc	11 bc	16 b	29 ab	45 a
Soil Wetter	12 bc	15 b	20 ab	42 a	64 a
Betta Wetta	12 bc	18 b	22 ab	49 a	57 a
Control	50 a	62 a	55 a	52 a	59 a

[1] Added on the basis of the solid containing 15% wetting agent. Numbers followed by the same letter are not significantly different with a probability of 95%.

The mixes were incubated at 25°C in plastic bags for 30 days. Samples were removed at 4, 8, 16, and 30 days for re-evaluation. The results (Table 3) show that there was a gradual to rapid decline in the effectiveness of the wetting agents. Those that were the least effective initially were also the first to lose effectiveness.

CONCLUSION

All test methods gave similar rankings of the wetting agents. The results indicate that mixes for short-term crops such as bedding plants will wet satisfactorily with 0.1 ml concentrate per liter mix. A new wetting agent can be rapidly compared with an existing one of known effectiveness using the pour-on technique and a 20-day incubation followed by assessment with the Australian Standard technique.

AN ALTERNATIVE TO THE AUSTRALIAN STANDARD METHOD

Assessment of the Short-Term Effectiveness of a New Wetting Agent. Dry some potting mix known to have poor rewettability. Fill it into standard or squat 100 mm nursery pots. The volume of mix in each pot must be the same. Allow at least four pots for control (water) and for each wetting agent being tested. Prepare solutions of the new wetting agent and one of Aquasoil Wetter or Wetta Soil. Each solution is to contain 1 ml concentrate per liter of solution. Slowly pour onto a pot a volume of solution equal to the volume of dry mix in the pot. Use water for the control pots. Allow drainage to finish; weigh each pot. The greater the amount of solution retained, the better the short-term effectiveness of the wetting agent.

Method for Estimating the Longevity of a Wetting Agent. Obtain enough mix known to have poor wettability to give 2 liters for each treatment. That means a minimum of 6 liters (2 liters for each of: control = no wetting agent; unknown wetting agent at 0.6 ml/liter mix; an excellent wetting agent (e.g. Aquasoil Wetter or Wetta Soil at exactly the same rate). Measure 2 liters of mix into each of three plastic bags.

Make up a dilute solution of each wetting agent containing 12 ml concentrate per liter of solution. Add 100 ml of this to 2 liters of mix. Add more water as needed to make the mix a little wetter than it would normally be for potting. Add plain water to the control mix. Make each plastic bag to the same weight. Thoroughly shake the mix and immediately remove about 600 ml. Store this in a plastic bag in a refrigerator.

Store the bags of incubating mix in a situation where the temperature will be reasonably constant, preferably in the range 20 to 25°C. Remove further 600 ml samples at 20 days.

From each 600-ml sample fill four plastic dishes, each holding about 100 ml. Disposable plastic dishes measuring about 75×75×22 mm are ideal. Proceed as described above in Expt. 1.

Acknowledgments. I thank the Australian Horticultural Research and Development Corporation for financial support and Mrs. J. Anderson for skilled technical help.

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