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Improvement of Emergence of Parsley Seeds by Post-sown Priming

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Summary

The efficiency of, and appropriate temperature, its duration and moisture content of a seeding mixture (Pretty Soil, type 140) for post-sown (PS) priming of parsley seeds were studied. The seeds were sown in flats packed with the seeding mixture adjusted to a moisture content of 45 and 50%, and primed at different temperatures for different periods of time in boxes to prevent the evaporation of moisture from the seeding mixture. Thereafter, the control unprimed seeds were sown and the treated and the control flats were fully watered and subjected to the conditions required for growth. In Experiment 2 and 4, during the treatments with moisture at 45 and 50% contents for 10 days at 15 ℃ and for 7 days at 25 ℃ seeds emerged at the rates of 20 to 40% and these seedlings were etiolated, indicating that these treatments were not appropriate. In the treatments at 15 ℃ for 7 days (Expriment 1) and at 25 ℃ for 5 days (Expriment 3), the percentage of emergence under the growing conditions of cabinets was almost always higher with a 45% moisture content than with a 50% moisture content. In Expriment 5, the emergence in the early days was more rapid in the treatment with a moisture content of 45% at 25 ℃ for 5 days than in the treatment with a moisture content of 45% at 15 ℃ for 7 days. In Experiment 6, the seeds in the treatment with a moisture content of 45% at 25 ℃ for 5 days, emerged earlier, faster and in larger numbers in a glasshouse, and grew into seedlings with a more uniform fresh weight than those in the absence of treatment. The treatment with the seeding mixture adjusted to a moisture content of 45% at 25 ℃ for 5 days was found to be suitable for PS priming.

Key Words: emergence, parsley, priming.

Introduction

Parsley seeds germinated very slowly (Thompson,1923). The germination percentage of parsley seeds commercially supplied from 1989 to 1998 in Japan was only 60 to 70 % (Annual Report of National Center for Seeds and Seedlings, Japan, 1999). Kato et al. (1978) reported that parsley seeds contained coumarin heraclenol which inhibits germination. Gibberellin treatment (Thomas, 1996) and priming in a polyethylene glycol (PEG) solution (Akers et al., 1987) improved the germination. In 1997 Miura et al. developed a new seed treatment, post-sown (PS) priming in a seeding mixture that had been very effective for the improvement of the emergence of Malabar spinach, *Basella alba* L., seeds. Therefore, we examined whether PS priming improved the emergence of parsley seeds and determined the appropriate conditions for PS priming.

Materials and methods

In July 1996 to July 1997, parsley, *Petroselinum crispum* Nym., seeds (' New Curl Summer ', Takii & Company, LTD, Japan) were sown in plastic flats with 32 cells that were cut from plastic flats (28 cm in width and 54 cm in length) with 128 cells (25 mL for each cell), packed with a seeding mixture adjusted to a water content of 45 and 50% (water weight/wet weight) by the addition of distilled water. The seeding mixture consisted of Pretty Soil (type 140, Otuka Sangyo, LTD, Japan, main material; 30% artificial inorganic substances and 60% organic matter, nutrient composition; 130-150 mg N, 1000-1500 mg P_2O_5 and, 130-150 mg$\cdot L^{-1}$ K_2O) with a moisture content of about 45%. Each flat sown was put into a plastic box (23 × 30 × 9 cm) to impede evaporation. In each Experiment 1 to 5, these boxes were kept for 5 to 10 days at 15 and 25 ℃ , the PS priming ended on the same date, and the flats were fully watered and transferred into a cabinet to induce growth. The plants were exposed to a photosynthetic photon flux of 60 $\mu mol \cdot m^{-2} \cdot s^{-1}$ under an 8hr photoperiod at 30/20 ℃ (day/night). In Experiment 6, the flats were fully watered and transferred into a glasshouse in July. For the control of each experiment, seeds were sown in the flats as above, fully watered and transferred into the cabinet or glasshouse without priming. Under the growing conditions, the number of seedlings that emerged was counted every day.

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Table 1. Effect of post-sown priming of parsley seeds in a seeding mixture with different moisture contents at 15 and 25 ℃ for different days on the emergence in cabinets.

Treatment	Emergence percentage (SE)			
	Days to emergence			
	0	5	10	20
Experiment 1				
Control[z]	0(0)	0(0)	4.2(2.8)	36.5(5.5)
15 ℃ /7d/45%[y]	0(0)	55.2(1.0)	76.0(4.2)	77.1(3.8)
15 ℃ /7d/50%	0(0)	36.5(7.3)	53.1(4.8)	56.3(3.6)
Experiment 2				
Control	0(0)	0(0)	8.3(3.8)	78.1(6.5)
15 ℃ /10d/45%	36.5(5.5)	90.6(3.1)	92.7(4.5)	93.8(3.6)
15 ℃ /10d/50%	19.8(2.8)	83.3(5.2)	85.4(4.2)	87.5(3.1)
Experiment 3				
Control	0(0)	0(0)	2.1(2.1)	61.5(5.2)
25 ℃ /5d/45%	0(0)	70.8(5.5)	91.7(1.0)	91.7(1.0)
25 ℃ /5d/50%	3.1(1.8)	58.3(2.8)	81.3(4.8)	89.6(2.8)
Experiment 4				
Control	0(0)	0(0)	0(0)	19.8(5.5)
25 ℃ /7d/45%	36.5(6.8)	78.1(4.8)	82.3(4.5)	85.4(3.8)
25 ℃ /7d/50%	33.3(4.5)	74.0(2.8)	81.3(4.8)	83.3(4.2)

[z]Nontreated control.

[y]Temperature/days/moisture content.

Three flats were used per treatment in Experiments 1 to 5, and 5 flats per treatment in Experiment 6.

About 10 g of the mixture with adjusted moisture content for each flat was dried at 105 ℃ for 2 days to determine the correct moisture content on a wet weight basis.

Results and Discussion

The actual moisture contents in the treatments with moisture contents of 45 and 50% , ranged from 45.0 to 46.4% and from 50.0 to 51.0%, respectively.

In the 15 ℃ experiment for 7 days (Experiment 1, Table 1), PS priming in the mixture with a 45% moisture content gave a higher emergence percentage at any time than that in the mixture with a 50% moisture content and the control (nontreated). In the 15 ℃ experiment for 10 days (Experiment 2), PS primings in the mixture with 45 and 50% moisture contents induced an emergence rate of 20 to 40% at the end of the period. These seedlings were etiolated and did not develop into normal transplants. Based on the results obtained, it was considered that these two treatments were not appropriate for seed treatment.

In the 25 ℃ experiment for 5 days (Experiment 3), PS priming in the mixture with a 45% moisture content led almost always to a higher emergence percentage than that in the mixture with a 50% moisture content and the control. In the 25 ℃ experiment for 7 days (Experiment 4), PS primings in the mixture with 45% and 50% moisture contents induced an emergence rate of 30 to 40% at the end of the period. It was considered that these two treatments were not appropriate for seed treatment.

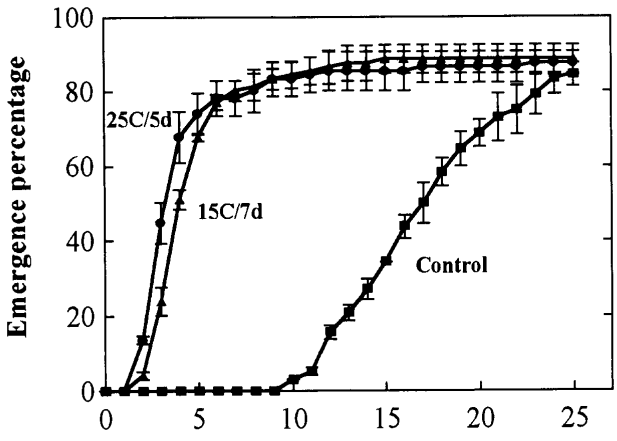

Fig. 1. Emergence curves of parsley seeds subjected to post-sown priming (Experiment 5). 25 ℃ /5d; seeding mixture with 45% moisture content at 25℃ for 5 days (●), 15℃ / 7d; seeding mixture with 45% moisture content at 15 ℃ for 7 days (▲), vertical bars; SDs.

The emergence percentages on the 20th day of controls varied with the experiments. This may have resulted from the differences in the population and storage period (several months after purchase to about one year in a desiccator at room temperature) of seeds and humidity in the cabinets for growth.

Table 2. Stand and growth of parsley seedlings from seeds subjected to post-sown priming in a seeding mixture with 45% moisture content at 25 ℃ for 5 days, and subsequent transfer to a glasshouse for 25 days (Experiment 6).

Treatment[z]	Emergence %	Stand[y] %	Top fresh weight per seedling	
			mg	Coefficient of variation (%)
Control[x]	60.9	49.2	16.1	64.5
25 ℃ /5d/45%	88.8	85.0	50.9	38.5
Significance[w]	***	***	***	

[z]Temperature/days/moisture content.
[y]Percentage of seedlings that spread true leaves compared to seeds sown.
[x]Nontreated control.
[w]***; significant at P=0.001 by t test for emergence and stand percentages converted into angles and for fresh weight.

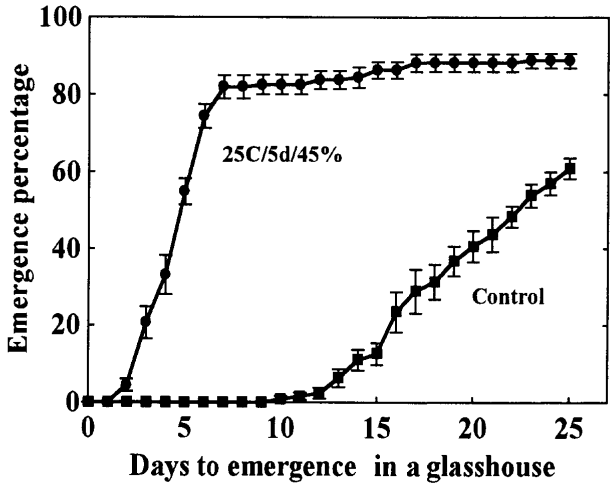

Fig. 2. Emergence curve of parsley seeds subjected to post-sown priming in a seeding mixture with 45% moisture content at 25 ℃ for 5 days (Experiment 6). Vertical bars; SDs.

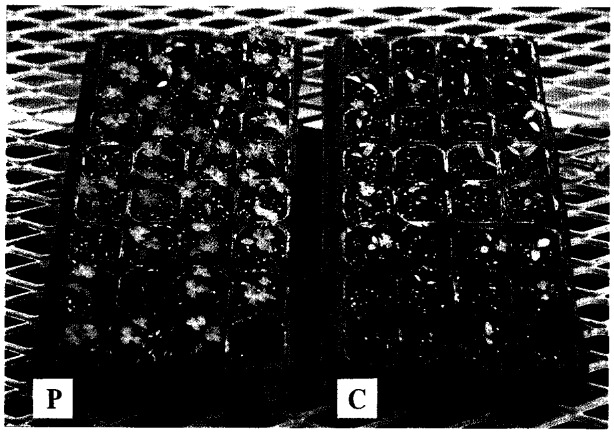

Fig. 3. Seedlings from seeds subjected to post-sown priming in a seeding mixture with 45% moisture content at 25 ℃ for 5 days, and subsequent transfer to a glasshouse for 25 days (Experiment 6). P; Subjected to post-sown priming. C; Nontreated control.

Analyses of the results of priming at 15 and 25 ℃ showed that the 45% moisture content at 15 ℃ for 7 days or that at 25 ℃ for 5 days was more effective. When the effectiveness of the two treatments was compared in Experiment 5 (Fig.1), the percentage of emergence was higher on the 2nd, 3rd and 4th days in the 45% moisture content at 25 ℃ for 5 days than in that at 15 ℃ for 7 days. Furthermore, the suitability of PS priming in the mixture with a 45% moisture content at 25 ℃ for 5 days for the raising of transplants was confirmed in Experiment 6 (Fig.2). In the last experiment, primed seeds began to emerge on the 2nd day and reached a maximum of about 80% 7th days after transfer to the glasshouse, whereas the control seeds began to emerge on the 11th day and attained a final emergence rate of about 60% on the 25th day. While 85% of the seeds primed at 25 ℃ for 5 days at 45% moisture content developed true leaves after 25 days in the glasshouse, only 49% of the control did (Table 2); the meam weights of the top of respective seedligs were 51 and 16 mg.

The appearance of the seedlings in the treated and the control seedlings are shown in Fig. 3. Coefficient of variation of the seedling weight (Table 2) was lower in the treatments than in the control, suggesting that the growth of the seedlings in the treatments was more uniform.

Ely and Heydecker (1981) reported that priming parsley seeds in a PEG 6000 solution (-1.2MPa, 15 ℃, 3 weeks) improved germination and emergence, and increased the fresh weight per plant. Akers et al. (1987), Pill (1986), and Rabin et al. (1988) also demonstrated the advantage of priming in a PEG solution for better germination and emergence of parsley seeds. However, seeds treated with a PEG solution must be washed and dried before sowing, a very laborious treatment. PS priming is simple; that is, seeds must only be sown in a seeding mixture with adjusted moisture content and kept under certain temperature and moisture conditions for several days, with subsequent transfer for growth.

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PSプライミングによるパセリー種子の出芽促進

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摘　要

水分含量を45あるいは50%に調整した培養土(プリティーソイルN-140)を詰めたセルトレイにパセリー‘ニュー・カールサンマー’種子を播種し，異なる温度に異なる期間維持して播種後(PS)プライミングを行った後，キャビネットあるいはガラス室に移して，出芽に及ぼす効果および好適条件を検討した．

15℃・10日間および25℃・7日間の処理の結果，水分45%区，50%区とも処理中に20~40%がもやし状に出芽してしまい，これらの処理は適切ではなかった．15℃・7日間および25℃・5日間の処理では，水分45%区が水分50%区よりもキャビネット内での出芽を促進した．15℃・7日間・45%区と25℃・5日間・45%区とを比較したところ，初期の出芽は後者で勝った．そこで，25℃・5日・45%処理種子をガラス室に移したところ，無処理種子区よりも出芽開始が早く，その後の出芽速度および出芽率も顕著に勝り，さらに芽生えの地上部重の変動係数が低く，生育量が均一であった．本実験の範囲において，セル苗対応のPSプライミングとしては，25℃・5日・45%処理が好適であった．

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