turnover of stock, plus superior plant health and quality.

However, to obtain a maximum return from the capillary bed, care must be taken:

1) To keep the beds well stocked throughout the year.

2) To establish management routines such as those outlined to ensure the most efficient functioning of the capillary system.

Over 9 months we have established routines necessary in management of capillary beds and our observations of plant growth and health have justified our decision to try this system.

EFFECT OF SOWING TIME ON PEACH ROOTSTOCK ESTABLISHMENT

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Abstract. The effects of four different seed sowing times, plus fungicide treatment, were evaluated for peach rootstocks direct-sown using seed from 'Golden Queen' peach. The two earliest sowings resulted in significantly higher seedling emergence and percentage buddable stocks, than later sowings. The second sowing time of May (late autumn) gave the highest seedling emergence (59.1%) giving 48.9% buddable stocks based on the number sown. Soil temperature and moisture were considered key factors influencing subsequent seed stratification, while prior handling and storage were also thought to influence the results. Fungicide treatment with thiram had no significant influence.

INTRODUCTION

The predominant method of propagating peaches is by T-budding of selected cultivars onto seedling peach stock. The choice of seed source, is not usually governed by any particular cultural value, but rather by ready availability of seed from the canning industry. Thus in New Zealand seedlings of the late maturing canning cultivar, 'Golden Queen', is the principal rootstock used for peach.

As with many temperate zone plants, peach seed requires a stratification period to promote germination. The conditions and length of the stratification period for peach is cultivar-variable (3, 4, 9) though from the literature 80 to 150 days at 4 to 10°C in a moist medium is usual (1, 3, 10, 12, 13).

The problems associated with peach propagation from seed vary according to climatic conditions. In warm temperate and subtropical regions the principal problem is the attaining of sufficient chilling to satisfy the stratification requirement (3). Once germination is achieved, seedling growth is such that stocks can be summer-budded and a satisfactory tree achieved within one year (7, 8, 13). However in cool temperate regions, attaining sufficient growth in the seedling to allow budding in late summer is more inclined to be a problem than provision of adequate winter chilling. Tree production under this system takes two years.

Management of the seedling under cool-temperate conditions is very critical. In New Zealand the traditional practice is to stratify in sand or sawdust and transplant the seedlings as they emerge. This has the advantage of allowing adequate spacing and uniformity of seedling age within rows.

In Canterbury, warm north-westerly winds in spring are common and these can severely check newly transplanted seedlings resulting in delayed budding. In response to this, some smaller nurseries in the Canterbury area have adopted a system of direct sowing. This method overcomes transplant problems and the associated costs of planting-out although it does involve thinning to ensure adequate spacing and results in variability in seedling size.

This paper reports on an experiment set up to investigate the effect of sowing time on seedling emergence and attainment of sufficient growth to allow budding at the optimum time under a direct sowing plus autumn budding system. A further objective was to evaluate the effect of seed treatment with the fungicide, thiram, at the different times.

MATERIALS AND METHODS

This experiment was located in Canterbury, New Zealand and was conducted over the 1984/85 season. The experiment was laid down within a 0.6 ha sheltered block on a Waikanui silt loam which had been in pasture for several years previously.

Seed from *Prunus persica* 'Golden Queen' were obtained from a cannery in the Hawkes Bay district. Prior to shipment the seed was dried in the open. On arrival the seed was stored in a cool locality indoors until sowing. Seed for fungicide treatment was dusted with a wettable powder formulation of thiram just prior to sowing.

Seed was hand-sown at four times: 26 April, 31 May, 5 July, and 5 August. This provided a separation of about five weeks between sowings.

Management of the trial followed the practice of the adjacent commercial block. Weed control was achieved by pre-emergence application of oryzalin (3.5 kg/ha a.i.) and simazine (0.75 l/ha a.i.) followed by spot spraying as required with paraquat/diquat mixture. There was no visible symptoms of toxicity from these chemicals. Peaches are sensitive to herbicides but are tolerant of oryzalin, and simazine at a very low rate (2, 5, 11).

The spray program for pest and disease control included regular applications of captafol and streptomycin with pirimicarb added when required for aphid control. Trickle irrigation was used when required.

The experiment was a randomised block design with five replicates and eight treatments. Each was sown with 100 seeds and seedling emergence was monitored regularly during the growing season, with the final assessment on 25 February, 1985. At this time seedling girth was measured with vernier calipers.

RESULTS

Seed treatment with fungicides prior to sowing had no significant influence on seedling emergence and this data is not shown.

Soil temperatures and progressive seedling emergence at the four different sowing times are shown in Figure 1. Early sowing resulted in a higher total percentage emergence and this was strongly reflected in the overall percentage of plants that were evaluated as being sufficient size for budding (Table 1). Emergence was particularly high for the second or May sowing while the two earliest sowings had significantly higher percentages than the later ones. April and May sowings yielded greater than 80% buddable plants which dropped to 65% for July and only 20% for August, of the number that emerged.

Figure 2 depicts emergence and suitability for budding as a percentage of the number sown rather than those that had emerged. This presents a more sober view of the yield of buddable plants related to the initial number sown. In the most successful sowing, 49% of the seed developed into buddable plants; it was similar for April but only 30% and 8% of adequate girth resulted from the two subsequent sowings.

Table 1. The influence of sowing time on emergence of peach seedlings and percent buddable stocks of those that emerged.

Date	Mean Percentage Emergence	Percentage of seedlings buddable
26 April	50.3	88.7
31 May	59.1	82.2
5 July	41.0	64.9
5 August	39.2	19.8
LSD (5%)	6.5	8.8
Significance levels:		
linear	$p < .001$ (**)	$p < .001$ (**)
quadratic	$p < .001$ (**)	$p < .001$ (**)
cubic	$p = .017$ (*)	$p = .225$ (NS)

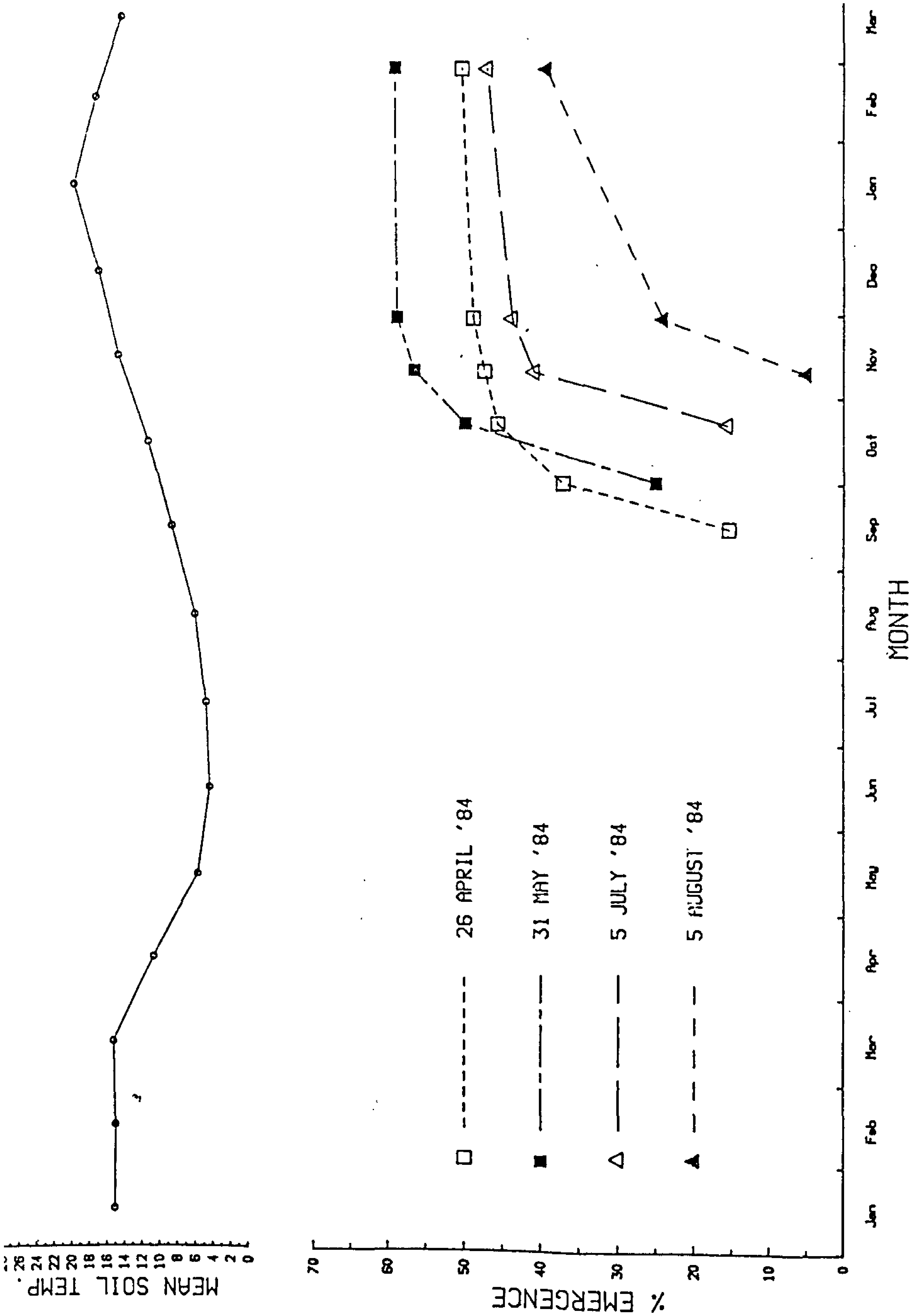

Figure 1. Soil temperatures and seedling emergence resulting from four different sowing times.

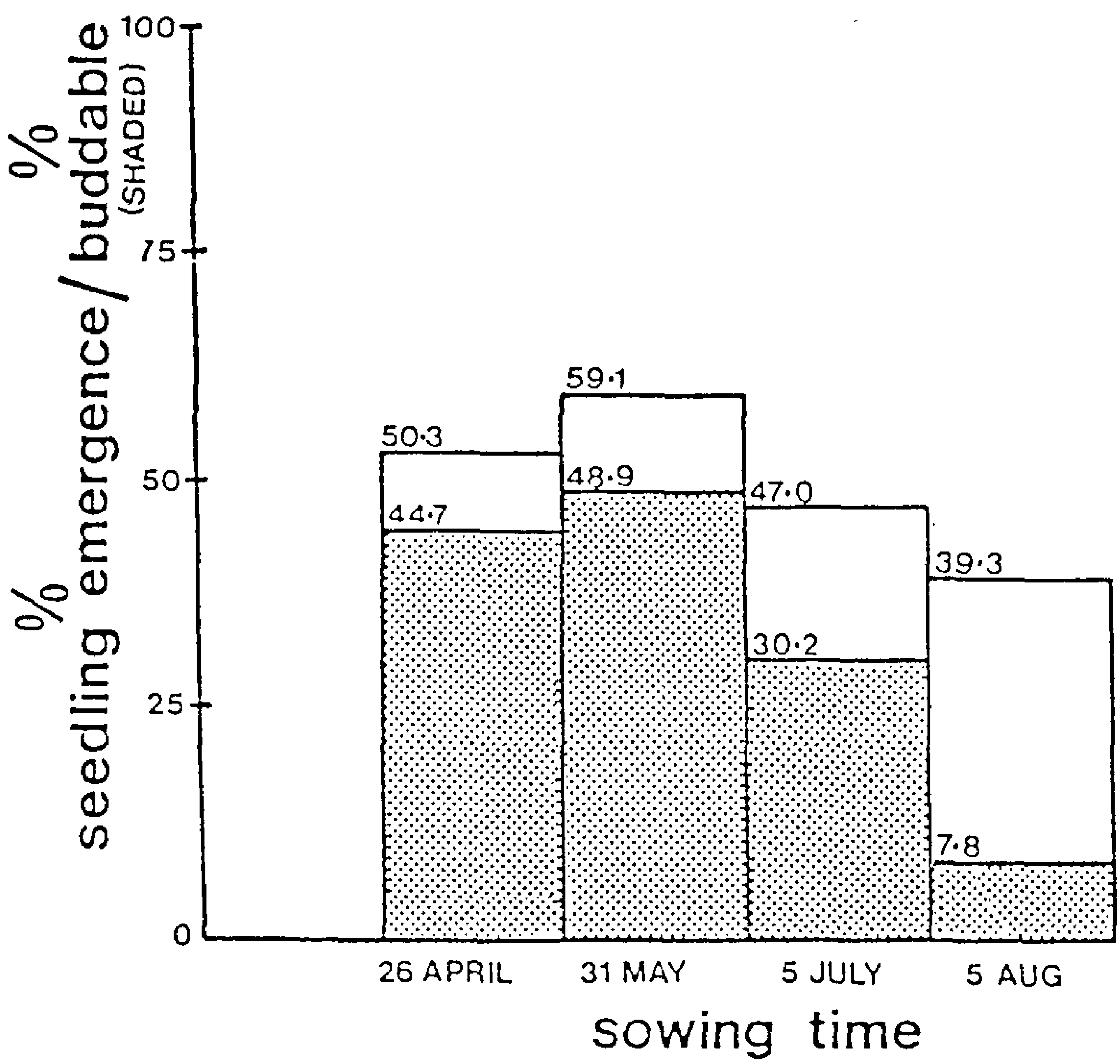

Figure 2. *Seedling emergence and suitability for budding as a percentage of the number sown.*

DISCUSSION

Early sowing resulted in a higher seedling emergence, earlier emergence and in a greater proportion of emerged seedlings being buddable by late February. These effects of early sowing time can be attributed to provision of adequate exposure to stratification conditions. Late sowing can result in a very low proportion of buddable stocks (Figure 2).

The higher emergence observed for the May sowing compared to the sowing in April was unexpected but may be due to overexposure to low temperature or induction of secondary dormancy in those sown in April. Guerriero and Scalabrelli (6) observed both phenomenon in a comparison of the effect of duration of stratification on seed of a number of peach rootstocks.

Even for the early sowings percentage emergence was not high (i.e. maximum of 59.1%). This may in part be due to the handling and storage of the seed prior to sowing. Briggs (3) observed a rapid decline in viability when seed was stored at 25°C, while at 6°C seed remained viable for a number of years. Briggs (3) and Harris (7) report a considerable improvement in percent emergence with drying under cool conditions, rather than outdoors in direct sunlight.

The key environmental parameters for successful stratification are soil temperature and moisture. As these can vary considerably among seasons and districts it is not possible to pinpoint the optimum sowing time in advance. However, these results demonstrate that in cool-temperate regions early sowing is essential for achieving sufficient seedling emergence and growth.

LITERATURE CITED

1. Anadoliev, G. 1974: Accelerated production of fruit tree planting material V. Peach planting material. *Gradinarska I Lozarska Nauka* 11(3): 50–55.
2. Arnold, C. E. and J. H. Aldrich. 1980: Herbicidal effects on peach seedling growth and weed control. *HortScience* 15(3): 293–294.
3. Biggs, R. H. 1966: Germination of 'Okinawa' peach seeds under the conditions of Florida. *Proc. Florida State Hort. Soc.* 79: 370–373.
4. Diaz, D. H. and G. C. Martin. 1972: Peach seed dormancy in relation to endogenous inhibitors and applied growth substances. *Jour. Amer. Soc. Hort. Sci.* 97(5): 651–654.
5. Gaynor, J. D., P. B. Marriage, and R. E. C. Layne. 1982: Weed management systems and herbicide residues in nursery trees and newly-planted peach orchards. *Proc. 1982 British Crop Prot. Conf.*: 255–261.
6. Guerriero, R. and G. Scalabrelli. 1985: Effect of seed germination on several peach line rootstocks. *Acta Hort.* 173: 185–190.
7. Harris, R. 1982: Propagating and producing stone fruit trees in one year. *Proc. Inter. Plant Prop. Soc.* 32: 78.
8. Hartmann, H. T. and D. E. Kester. 1983: Techniques of budding. Chap. 13, in Plant Propagation: Principles and Practices, 4th ed. Prentice-Hall, Englewood Cliffs, New Jersey: 448–471.
9. Hundel, P. S. and H. N. Khajuria. 1979: Seed development and germination in different peach cultivars. *Jour. of Res.*, India. 16(3): 291–294.
10. Medina, J. P. 1973: Propagation of *Prunus persica* in Ica, Peru. *Plant Propag.* 19(2): 15.
11. Rom, R. C.; S. A. Brown, and E. H. Arrington. 1978: Tolerance of young peach trees to two pre-emergence herbicides. *Arkansas Farm Res.* 27(3): 3.
12. Rouskas, D. and J. Hugard. 1982: The possibility of using a cytokinin alone or with other growth regulators to break the dormancy of seeds of rosaceous fruit trees of the genus *Prunus*. *Fruits* 37(3): 195–202.
13. Sharma, H. C. and R. N. Singh. 1978: Effect of stratification of temperature, stratification period, and seed coat on seed germination of peach cultivar 'Sharbati'. *Scient. Hort.* 9(1): 47–53.