In summary, it would appear that 'Bluebell,' 'Veeblue,' 'Mont-Royal' and 'Stanley' are suited to Quebec growing conditions. 'Reine Claude' and 'Victoria' are two other choices. Growers should make certain that the trees are planted in good soil and that sufficient water is available.

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Research on Flower Thinning of Early-Ripening Peach and Nectarine with Urea

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Abstract

With the purpose of regulating the crop load, several low biuret urea concentrations (4, 8, 12% and 12, 16 and 20%) in two following years were sprayed during full bloom on 'Armking' and 'Springred' nectarines and 'Springcrest' peach. One month after the treatment a complementary hand thinning was carried out in order to adjust the fruit load. The degree of thinning was floral-stage-dependent and the best results were obtained at 12% dosage. Trees sprayed with concentrations higher than 12% showed toxic symptoms whereas those treated with solutions containing less than 12% of urea did not differ in crop load from the control plants.

It is well known that the most effective orchard cultural practice for increasing fruit size is to adjust the crop load to the leaf area by thinning out the reproductive organs of the tree. In peach, especially in the early ripening cultivars, with a short fruit development period, bloom thinning is more effective than fruitlet thinning (1, 4, 5). Several compounds work quite well in reducing bloom; ammonium thiosulphate (2, 3) and urea (7) have recently been successfully employed as thinning agents in peach. However, application time for ammonium thiosulphate is quite short (from close pink bud to flower stage). When applied at the right dosage, urea can be effective until fruit set without seriously burning new leaves (7). To verify the possible use of urea in regulating fruit load in an early ripening peach and two nectarines the following trials were carried out.

Materials and Methods

Research was carried out in Sicily (37°41 Lat. N) in a commercial orchard established with dormant budded rootstocks of GF 677 in January 1984. The trees were spaced 4 x 2 m and trained in a "fusetto" (free spindle) shape. Low biuret (less than 0.1%) urea at different concentrations (4, 8, and 12% in 1989; 12, 16 and 20% in 1990) in water solution, with 0.5% "Scam" surfactant added, was sprayed. For all three cultivars, each urea concentration was applied to whole five-tree replicates in a randomized three-block design. In 1989 'Armking' and 'Springcrest' were treated on 10 March and 'Springred' on 17 March. In the following year 'Armking' was sprayed on 12 March, 'Springcrest' on 16 March and 'Springred' on 30 March.

To establish the stage of bloom, the stage reached by each reproductive organ of five shoots per tree was

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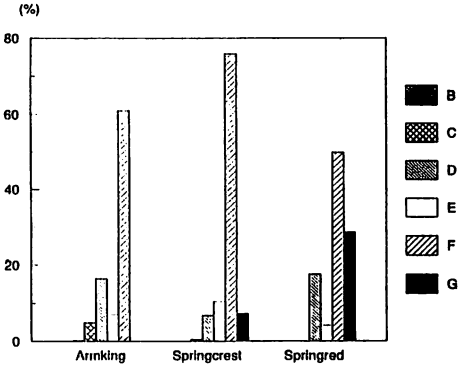

Figure 1. Distribution of developmental phases of flower buds at the time of treatment (B = swelling bud; C = bud scales separated, sepals exposed; D = sepals separated, petals exposed; E = petals slightly separated, stigma and anthers visible; F = open flower; G = fruitlet — 1989 trials).

recorded; data were coded according to the following scheme: B = swelling bud; C = bud scales separated, sepals exposed; D = sepals separated, petals exposed; E = petals slightly separated, stigma and anthers visible; F = open flower; G = fruitlet (6). Complementary hand thinning was carried out on whole trees about one month after spraying on 'Armking' and 'Springcrest' and about 40 days on 'Springred,' leaving one fruit every 20-25 cm of shoot length.

The effectiveness of the urea treatment was determined on the basis of the following parameters: shoot length, fruit set and fruitlet drop measured on five shoots on each tree; number and average weight of fruitlets removed by hand thinning, number and weight of fruits at harvest, percentage of fruit at first picking, fruit distribution by diameter classes and trunk cross-sectional area 10 cm above the graft union determined for each tree.

Analyses of variance and regression were carried out separately for each cultivar and for each year using SPSS-X statistical package at 0.01 protection level (only significant regression lines are shown).

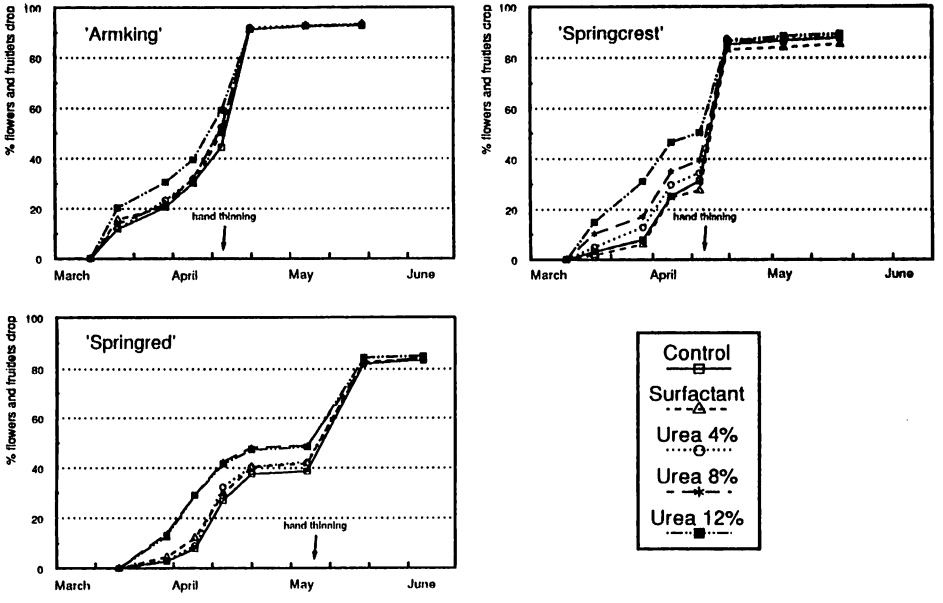

Figure 2. Flowers and fruitlets drop evolution as affected by urea treatments at different concentration (1989 trials).

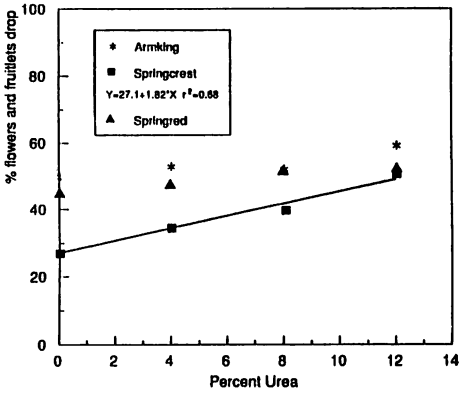

Figure 3. The effect of urea concentration on flowers and fruitlets drop (data recorded just before complementary hand thinning — 1989 trials). Significant regression lines (α = 0.01) are shown.

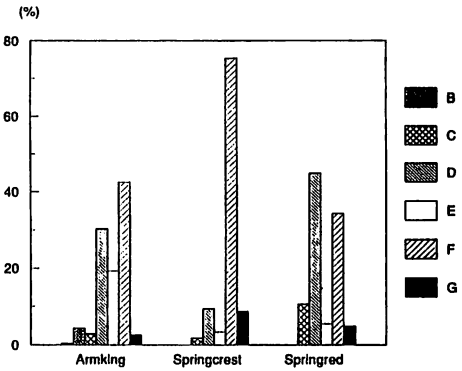

Figure 4. Distribution of developmental phases of flower buds at the time of treatment (B = swelling bud; C = bud scales separated, sepals exposed; D = sepals separated, petals exposed; E = petals slightly separated, stigma and anthers visible; F = open flower; G = fruitlet—1990 trials).

Results

1989 trials

About 61, 78 and 83% of the flowers were open (stage F) in 'Armking,' 'Springred' and 'Springcrest' respectively on the treatment dates (Fig. 1). When applied at 8 and 12% concentration the caustic effect of urea on the reproductive organs was evident both in peach and nectarines one week ofter the treatment (Fig 2). Just before complementary hand thinning only 'Springcrest' showed a positive linear relationship between urea concentration and fruitlet drop (Fig. 3).

1990 trials

Due to the mild winter 1989/90 'Springred' showed the typical symptoms of unsatisfied chilling so that on March 30th, even if only 39% of the flowers were open, the urea treatment was carried out because the vegetative buds were sprouting. 'Armking' and 'Springcrest' were sprayed when, respectively, 45% and 84% of the flowers were open (Fig. 4).

In both nectarines, just before complementary hand thinning, the percentage of fruitlets drop was related to the urea concentration (Fig. 5) so that the number of fruitlets hand thinned per unit trunk cross-sectional area decreased as the urea concentration increased (Fig. 6). 'Springcrest' was so sensitive to the lower dosage (12%) that the treatment at higher concentrations did not statistically increase the fruitlets drop (Fig. 5). The urea concentration lowered the amount of fruits manually thinned in the nectarines tested (Fig. 6) and the crop efficiency

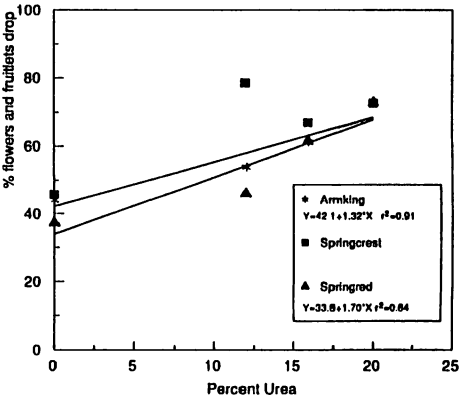

Figure 5. The effect of urea concentration on flowers and fruitlets drop (measured just before complementary hand thinning—1990 trials). Significant regression lines (α = 0.01) are shown.

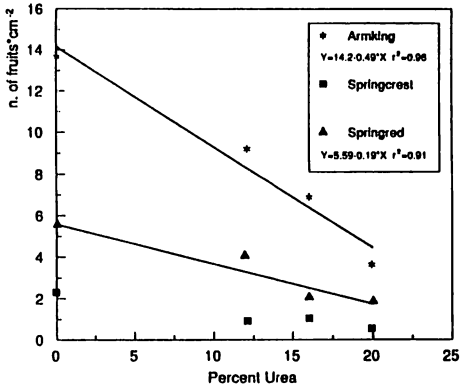

Figure 6. The effect of urea concentration on the amount of fruits manually thinned per unit trunk cross-sectional area (1990 trials). Significant regression lines (α = 0.01) are shown.

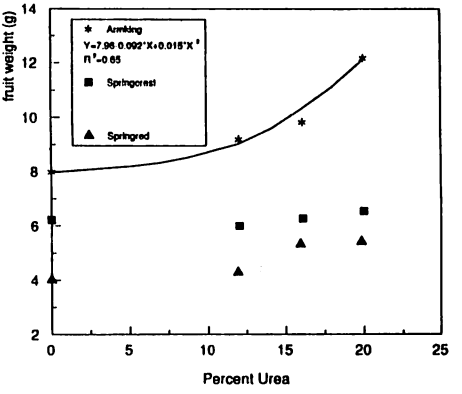

Figure 8. The effect of urea concentration on the average fresh weight of manually thinned fruits (1990 trials). Significant regression lines (α = 0.01) are shown.

(yield harvest in ratio to the trunk area unit) in 'Armking' and 'Springcrest' (Fig. 7). 'Armking' was the only cultivar in which the average weight of hand thinned fruitlets was linked to the urea concentration (Fig. 8). Although at the higher concentration (20%) urea caused dieback in several twigs, it only reached a toxic effect in 'Springcrest' and even reduced cross-sectional area growth (Fig. 9).

Discussion

The effect of urea as a thinning agent on peach depends on the interaction between its dosage and the blooming habit of the cultivars (i.e. concentrated or gradual). Concentration lower than 12% had no effect unless at least 80% of the reproductive organs were at the most sensitive stage of open flower ('Springcrest' in 1989). The high increase in fruitlet drop obtained in all the cultivars from 12 to 20% urea treatment emphasizes that all the stages of flower and fruitlet development are sensitive to urea concentrations higher than 12%. This means that overthinning should be expected if the dosage passes this threshold

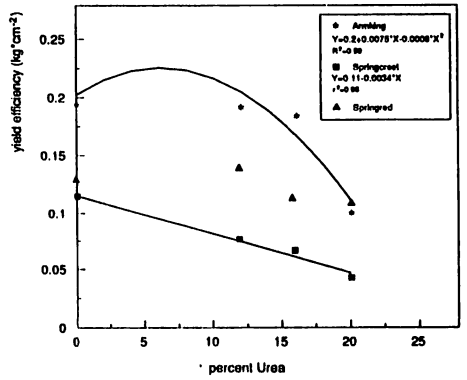

Figure 7. The effect of urea concentration on yield efficiency (yield per tree/trunk cross-sectional area—1990 trials). Significant regression lines (α = 0.01) are shown.

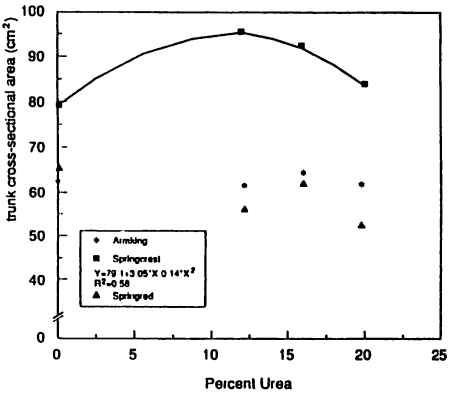

Figure 9. The effect of urea concentration on trunk cross-sectional area (1990 trials). Significant regression lines (α = 0.01) are shown.

value. However, once again, 12% concentration worked well in thinning reproductive organs in 'Springcrest,' probably because of the higher percentage of open flowers at the time of treatment. The type of flower (showy or not showy) does not explain the differences in behaviour of the cultivar since 'Springred,' as well as 'Springcrest,' has showy flower type.

In the two nectarines, characterized by a gradual blooming habit (Fig. 4), 16% urea treatment obtained the best results while in 'Springred' the 20% treatment overthinned the reproductive organs (Figs. 5, 6 and 7).

Unfortunately, in the prevailing conditions, in these nectarines when a high percentage of flowers are open, lateral vegetative buds as well as apical shoot may be growing so that twig dieback and leaflet burn could occur in the trees sprayed even with the lowest urea concentration. After three months, vegetation of trees damaged by 16-20% urea treatment recovered completely although the canopy became too dense and required severe summer pruning to give the appropriate shape back to the trees.

The effectiveness of urea as a thinning agent in peach is dependent from stage of development of the flowers bloom and from the concentration of chemical. Below 12% concentration the sensitivity of reproductive organs seems to be stage-dependent, with open flower being the most sensitive stage. At higher concentration the caustic effect seems to prevail over the reproductive organ stage. Hence, overthinning may occur even in cultivars characterized by a gradual blooming habit. Better results could be expected from further research on the interaction among reproductive organ sensitivity, urea concentration, different temperature and humidity levels. However, since urea treatments result in uneven distribution of the fruits along the shoots, a complementary fruitlet hand thinning is required.

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'Gala' Maturity

In a recent article in the *Good Fruit Grower* (V42(6):6-10) workers from Maryland compared 'Gala' to its 3 red sports ('Royal,' 'Regal,' and 'Imperial'). They concluded that red clones still require spot picking and that the striped clones are prone to reversion. 'Royal Gala' that were harvested late looked similar to 'Starking Delicious.' They reported no inherent differences in taste among the clones.

In a study of 'Gala' grown in Maryland they found that during maturation ethylene evolution rate, red color, Hunter 'a' values and fruit size increased while firmness and starch decreased. In 1990 starch iodine test scores were found to be best correlated with ethylene evolution rate. Since there are no published charts for 'Gala' the charts for 'Empire' were used, as these most closely approximated changes in 'Gala.' Starch index also appeared to be a good predictor of rain cracking potential. Stem cavity cracks are a problem with 'Gala' when fruits are allowed to hang late for size and color cracking can develop. Fruits harvested at a starch index of 4 tended to have the best quality for storage and minimal cracking potential.