Floral Induction Study in Mango in Guadeloupe

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Fruits, vol. 49, n°5-6
p. 355-358 (English)
p. 450-452 (French)

Mango trees were treated with several flower-inducing substances by leaf spraying and undertree irrigation applications. The initial results highlight the promising mango cropping potential in the Lesser Antilles.

introduction

Two mango cultivars (Haden and Eldon) from Florida (USA) were introduced in Guadeloupe in the early 1980s with the aim of developing the export mango industry. However, some flowering problems were noted when these trees were grown under prevailing conditions in Guadeloupe. Flowering was found to be poor and highly irregular (December to April flowering period) in lowland areas. These cultivars also show quite marked biennial bearing.

Irrespective of the varietal factor, this situation could be explained by several climatic conditions:
– irregular and often insufficient dry period,
– high humidity,
– high mean temperatures year-round.

The fumigation technique has long been used in India and the Philippines for flower induction. By this technique, trees are fumigated for several days until the appearance of inflorescences; the operation is repeated 2 months later if no flower bud burst occurs within 15 days. The results, however, are often poor and the operation is expensive and labour intensive.

Chemical treatments were successfully tested at the beginning of the 1970s. In the Philippines, for instance, potassium nitrate spraying treatments were carried out from 1970 to 1978, and yields were thus increased threefold (Anonymous, 1978).

Several other countries, particularly Mexico, have obtained positive results by adapting these techniques to their local conditions (Nuñez-Elisea, 1986 a & b; Nuñez-Elisea & Caldeira, 1987).

In the present study, two different flower induction treatments were conducted with these substances in a CIRAD-FLHOR research orchard at Vieux-Habitants (Guadeloupe).

material and methods

comparison of two flower-inducing substances on cv Eldon mango

Two flower-inducing substances, Flowerset (Bayer) and Miracle Blum Powder (Philippine Orchard Corp.), were tested in January 1991 on cv Eldon mangos grafted on 10 year old non-improved local mango trees.

Flowerset (240 g potassium nitrate/l) was applied by leaf spraying at 15 cc/l (36 g/l postassium nitrate).

The chemical composition of Miracle Blum Powder is not given, but analyses indicated a total nitrogen content of 25%, 14.5% as ammonium and 10% as nitrate. Part corresponds to ammonium nitrate, and the rest (about 1/3 of the ammonia

form) to other salts (phosphates, sulphates, chlorines, etc.). It was applied at 15 g/l.

These substances are often used instead of raw potassium nitrate in the Philippines since, for military security reasons, it is sometimes difficult to obtain authorization to use the latter compound (ANONYMOUS, 1978).

For each treatment, seven trees were treated by leaf spraying (about 14 l solution/tree). For practical reasons, only the lower 2/3 of the foliage was treated.

comparison of three flower-inducing substances on cv Haden mango

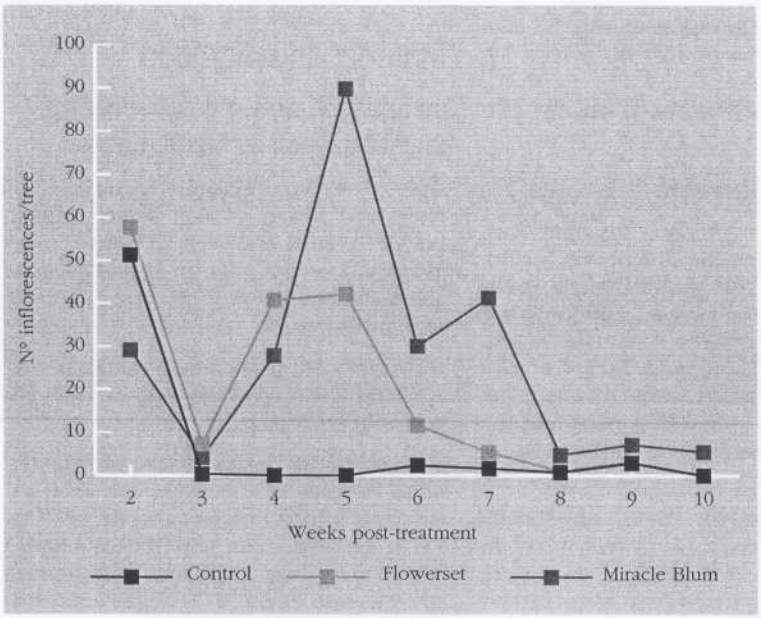
Since the preliminary flower induction tests with cv Eldon were successful, a second experiment was carried out in March 1991. However, only nitrate treatments were undertaken because data for the Miracle Blum Powder trial was not yet available.

Young 3 year old cv Haden mangos grafted on local non-improved mango trees were treated in this second experiment. Terminal buds on all trees tested were at the swelled or dormant stage. Paclobutrazol, a growth regulator commonly applied to increase yields in mango and other fruit trees, was used as a control compound for the potassium nitrate treatments (VUILLAUME, 1987; VUILLAUME & NYEMBI, 1991; VOON *et al.*, 1989).

Four different treatments were carried out with three flower-inducing substances:
– Flowerset (240 g/l potassium nitrate): 15 cc/l by leaf spraying (10 l/tree),
– potassium nitrate: 10 and 40 g/l by leaf spraying (10 l/tree),
– paclobutrazol: 60 cc Cultar (ICI) in 20 l water by undertree irrigation followed by sprinkling.

This test was carried out along a uniform line, at two trees/plot, two replications and adjacent controls.

Figure 1
Flower induction treatment on cv Eldon mango: mean inflorescence number/tree.



results

comparison of two flower-inducing substances on cv Eldon mango

Figure 1 shows the positive effects of two flower induction treatments as compared to the control: after the natural flowering stage (T + 15 d) in controls and treated trees, flowering began on the treated trees (peak at T + 35 d); the best results were obtained with Miracle Blum Powder.

The flower-inducing substances markedly increased yields, as measured by the harvested fruit quantities and weights (Figures 2 & 3).

However, there were no differences between the three treatments when separate fruit weights were analysed (control 480 g; Flowerset 530 g; Miracle Blum Powder 490 g).

comparison of three flower-inducing substances on cv Haden mango

The three potassium nitrate treatments had a positive effect on flower induction (bud burst at T + 15 d and full flowering at T + 35 d), and on fruiting (Table 1).

The Cultar treatment had almost no effect on flowering. The dwarfing effect of the compound was confirmed, i.e. shortening of the last internodes and a weeping branch habit.

discussion

effects of nitrates

In both experiments, potassium nitrate was found to induce flowering when applied by leaf spraying at a specific physiological stage: swelled and dormant terminal buds and brittle dark-green leaves, corresponding to a branch age of 6-7 months.

Ammonium nitrate was also found to induce flowering in the Miracle Blum Powder treatment. However, the exact role of this compound would be difficult to determine because of the complex chemical composition of this product.

The present results generally confirmed the hypothesis of NUÑEZ-ELISEA (1986) that nitrate ions have a prime role in the chemical flower induction process in mango.

potassium nitrate treatment dose

The results indicated an ideal potassium nitrate treatment dose of 10 g/l, applied in March, to obtain flower induction in cv Haden under the prevailing climatic conditions of Guadeloupe.

In the Colima region of Mexico, a dose of 40 g/l has been recommended for cvs Haden and Manila with treatments beginning in the first 2 weeks of November. In the Philippines, a dose of 10 g/l is effective for cvs Pico and Carabao with treatments in February or October.

The treatment dose can therefore be adjusted according to varieties, and the application date should be set in terms of the physiological stage of the branches.

application dates

Treatments in mid-January on cv Eldon and mid-March on cv Haden led to an increase in natural seasonal flowering and induction of late season flowering.

These techniques should now be assessed in terms of reproductivity and the effects of treatments relative to the physiological stages of branches and climatic conditions.

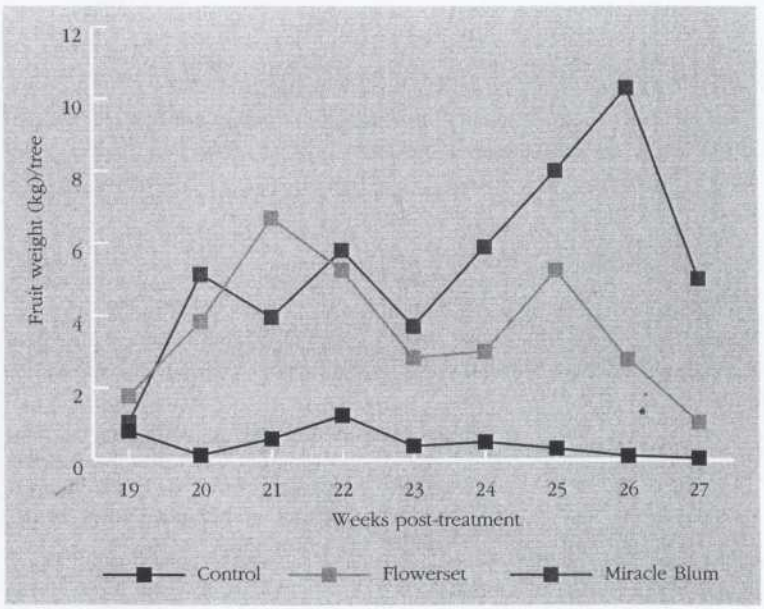


Figure 2
Flower induction treatment on cv Eldon mango: mean fruit weight/tree.

effect of paclobutrazol

The very poor results obtained with the paclobutrazol treatment could be explained by several factors:
– the young age of the plants treated (3 years),
– the low paclobutrazol sensitivity of the varieties tested,
– the low late-season flower-inducing efficiency of paclobutrazol.

Figure 3
Flower induction treatment on cv Eldon mango: mean fruit number/tree.

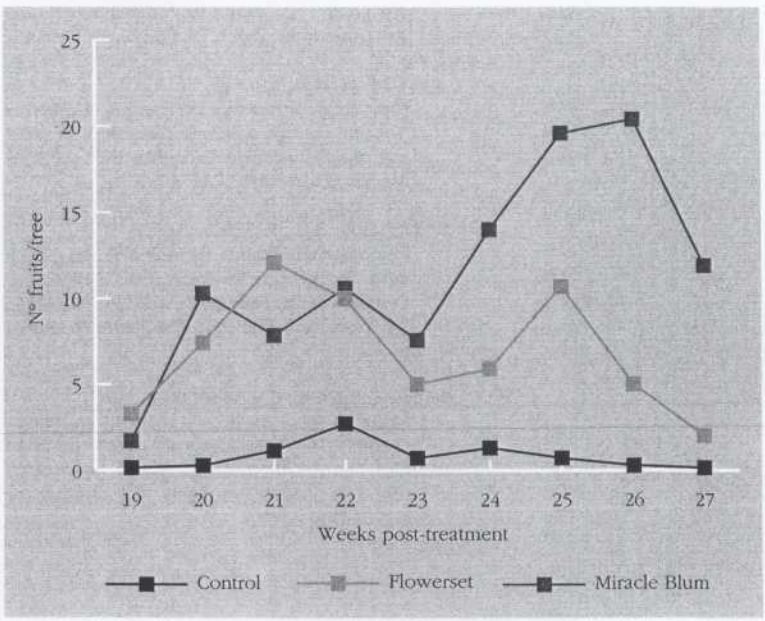


Table 1
Results of the flower induction treatment with cv Haden.

	Flowers/ tree	N° fruits/ tree	Fruit weight/ tree (kg)	Size
Control	1.76	0.94	0.37	0.39
KNO_3 10 g/l	59.25	25	7.16	0.29
KNO_3 40 g/l	32.75	14	4.3	0.31
Cultar	0	0	0	0
Flowerset	77	32	10.76	0.34

In these conditions, it would be interesting to compare the growth-reducing effects of paclobutrazol with the flower-inducing effects of nitrates (VOON *et al.*, 1989).

conclusion

These initial positive results could lead to more harmonious and reliable development of mango cropping in Guadeloupe and throughout the lesser Antilles.

Although further experiments should be carried out to improve cropping techniques, under the treatment conditions investigated in this study, it seems possible to obtain:
– more uniform flowering,
– a reduction in biennial bearing,
– late season flower induction.,

However, in the light of the present know-how, these techniques will probably not enable year-round mango production under the highly irregular tropical climatic conditions in Guadeloupe.

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