Study case 04

TEMPORAL MANAGEMENT OF POLLINATORS ALLOWS CHOOSING MARKETS: THE CASE OF MELON (*Cucumis melo*) IN NE BRAZIL

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Successful pollination in agriculture is highly dependent on the plant's pollination requirements, expressed mainly on its physiology and floral biology. These two main factors will establish whether the plant species is attractive or not to pollinators, influence their foraging behaviour and determine their visits will result in pollination and seed/fruit set. Therefore, it is important to understand about the plant's pollination requirement before setting any pollination programme.

A variety of floral visitors have been recorded in melon (*Cucumis melo*) flowers, but honey bee (*Apis mellifera*) is the only species so far that can be managed for melon pollination (Kato, 1997; Freitas, 1998; Holanda Neto et al., 2000a,b).

In the variety *inodorus*, 98% of Brazilian melon production, male flowers appear 18 to 25 days after sowing and hermaphrodite flowers 3 to 5 days later (Duarte, 2001). At the beginning of blooming (23 days after sowing), melon plants produce an approximate proportion of 8 male flowers to 0.1 hermaphrodite flower per day, but at full bloom (28 days after sowing) this proportion decrease to 8.7:1.0 (Sousa, 2003). This floral expression, associated to the plant's physiology proved to be important aspects in determining the standard (size and weight) of melon fruits and should be used by growers and beekeepers to establish the timing to introduce honey bee colonies in plantations according to the market aimed by growers (Tables 1 and 2).

Table 1 – Variation in total fruit yield and fruit quality depending on the period of introduction of honey bee (*Apis mellifera*) colonies in melon (*Cucumis melo*) plantation in Acarau, state of Ceara, Brazil.

Beehive introduction (Days after sowing)	**Total fruit yield (kg/ha)**	**Export standard (kg/ha)**	**Internal market standard (kg/ha)**
23	22,323.50 ? 252.2 a	9,817.50 ? 486.8 b	12,506.00 ? 1,544.6 a
28	16,323.50 ? 826.4 b	8,660.00 ? 436.6 c	7,663.50 ? 625.2 b
33	16,300.50 ? 805.8 b	12,290.00 ? 518.1 a	4,010.50 ? 792.8 c

Means followed by different letters in columns differ at P<0.05.
Source: Sousa (2003).

Table 2 – Variation in fruit weight and number of seeds per fruit depending on the period of introduction of honey bee (*Apis mellifera*) colonies in melon (*Cucumis melo*) plantation in Acarau, state of Ceara, Brazil.

Beehive introduction (Days after sowing)	**n**	**Fruit weight (g)**	**Number of seeds/fruit**
23	20	1,980.0 ? 298.2 a	552.3 ? 19.1 a
28	20	1,570.0 ? 324.3 b	549.4 ? 18.7 a
33	20	1,245.6 ? 327.0 c	543.2 ? 22.1 a

Means followed by different letters in columns differ at P<0.05.
Source: Sousa (2003).

The tables above show clearly that in agriculture pollination cannot be simplified to increase the number of pollinators in the target area. Knowledge about the plant specie's physiology and when introducing pollinators and other aspects not related here, can be as important as the pollination itself. Because melon is extremely dependent on biotic pollinators and wild pollinators are scarce in melon fields due to a series of reasons, but mainly deforestation and intensive use of agrochemicals, manipulating the introduction of supplementary pollinators (honey bee colonies) to melon fields can adjust fruit production to pre-determined standards of size and weight.

This is possible because at initial blooming, around 23 days after sowing, there are few hermaphrodite flowers, all of them produced close to the base of the plant, abundance of pollen and plenty of nutrients to 'feed' any fruit set. Thus, if honey bee colonies were introduced at this blooming stage setting the flowers available, melon plants will concentrate their nutrients in the growing the few fruits set and setting of later flowers (in branches) will e much reduced. As a consequence, total yield in weight is high, but mainly due to the production of big and heavy fruits (almost 2kg), rather than in number of fruits (Tables 1 and 2). This kind of fruit represents approximately 60% of production and is adequate only for the internal market.

Should the introduction of honey bee colonies be delayed until full blooming (28 days after sowing), some of the base flowers will already have withered and branch flowers will be present. In this new physiological stage of the crop, both base and branch flowers will be set simultaneously and compete for nutrients in even conditions. In such a situation, base flowers originate internal market standard fruits, although a bit lighter and smaller than in the former situation, while branch flowers produce much lighter and smaller fruits according to standards for export (Tables 1 and 2). Total yield (weight) is reduced by 27% due to lighter fruits and the proportion of internal and external market is 1:1.

Finally, if honey bee colonies were introduced only at 33 days after sowing, they will find few base flowers and abundant branch flowers. In this case, number of fruits set increase, but there is great competition for nutrients and most fruits originate from branch flowers, being light and small (Tables 1 and 2). Total yield (weight) is similar to the previous situation because the greater number of fruits compensates their lighter weight, but the proportion of export standard fruits reach 75%.

It is concluded that based on some knowledge about the flowering expression and physiology of melon plants, growers can chose the appropriate time to introduce honey

bee colonies for pollination in their crops and, therefore, control the standard of melons to be produced according to the market they are targeting that season. This procedure can reduce uncertainties and increase profits.