5 factors AFFECTING FRUIT SET

Expert advice on getting the best out of your Japanese plums. By Anna Mouton

The past season was remarkable for the disastrous set in certain Japanese plum cultivars in some areas, most notably the Breede River Valley and Klein Karoo. But poor set costs the plum industry every year. Fresh Quarterly asked four experts for their practical advice on achieving more consistent fruit set: Mike Allsopp, pollination specialist with the Agricultural Research Council; Petru du Plessis, horticultural advisor and stone fruit grower; Prof. Wiehann Steyn, assistant general manager at Hortgro Science; and Prof. Karen Theron, Chair in Applied Preharvest Deciduous Fruit Research at Stellenbosch University.

1. Cross-pollination

Japanese plums require cross-pollination. The cross-pollinator and the main cultivar must have overlapping flowering periods. Keep in mind that the flowering period can shift depending on winter and spring temperatures. Cultivars with a high chill requirement are more prone to shifting after a warm winter than cultivars with a low chill requirement. Combine cultivars with similar chill requirements for the best results.

The risk of poor overlap due to shifting flowering periods can be partly mitigated by planting two cross-pollinators instead of one.

Some plum cultivars are incompatible due to genetics — see the explanation of *S*-alleles in our feature article on fruit set for more details. Independent cultivar evaluation company Provar collaborated with molecular-genetics service provider CenGen to determine the *S*-allele-profiles of a range of common cultivars. They have produced the tables on pages 13 and 15 that show which are compatible. Growers are advised to plant fully compatible cultivars where possible.

The ratio of cross-pollinators to main cultivar trees is important. Too few cross-pollinator trees will result in disappointing fruit set. Some cultivars set more readily than others so beware of applying a fixed percentage of cross-pollinators for all orchards. The industry norm is one cross-pollinator to every nine main cultivar trees but some experts recommend a minimum of one cross-pollinator to every three main cultivar trees. Use the higher ratio of cross-pollinators for cultivars that are shy to set.

Some plum cultivars are incompatible due to genetics.

Pollination success may be improved by planting cross-pollinators in every row — bees tend to move down rows rather than between rows.

2. Bees

The flowers of Japanese plums are white and contain relatively little nectar. They are less attractive to bees than spring-flowering weeds and fynbos. Bees assess the food sources that are available in a three kilometre radius of the hive and allocate their field force to the most worthwhile flowers — which in their opinion are often not plums. Plum cultivars can vary as much as ten-fold in the sugar concentration of their nectar and their pollen is also not very appealing to bees.

TABLE OF PLUM CULTIVARS & POSSIBLE CROSS-POLLINATORS IN ORDER OF FLOWERING FROM EARLY TO LATE

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CHOICE OF CROSS-POLLINATOR / MAIN CULTIVAR	Rubynell	African Rose*	Pioneer*	African Delight	Black Splendor	Harry Pickstone*	Suplum 6 (Angeleno)	Sapphire	Purple Majesty	Black Pearl	Fortune	Ruby Sun	Souvenir	Inbar	Big Night	Mark	SunKiss	Green Red	Red Diamond	Sun Breeze	Ruby Crunch	Sun Supreme	Marco	Suplum 11	Suplum 39	Starplum 6	John W	Larry Anne	Laetitia	Songold	K2-261	Earlamoon	Lamoon	Late Shefer	Sweet Christine	Polaris	Ruby Star	Southern Belle
African Rose*																																						
Pioneer*																																						
African Delight																																						
Black Splendor																																						
Suplum 6 (Angeleno)**													†																									
Sapphire																																						
Purple Majesty	†					†																																
Black Pearl																																						
Fortune																																						
Ruby Sun																																						
Souvenir																																						
Inbar																																						
Big Night																																						
Mark																																						
SunKiss																																						
Green Red																																						
Red Diamond																																						
Sun Breeze						†											†																					
Ruby Crunch																																						
Afrigold																						†																
Sun Supreme																																						
Marco																																						
Suplum 11																																						
Suplum 39																																						
Starplum 6																																						
John W																																						
Larry Anne																												†	†									
Laetitia																																						
Songold																																						
K2-261																																						
Earlamoon																																						
Lamoon																																						
Late Shefer																																						
Sweet Christine																																						
Polaris (Starplum 7)																																						
Ruby Star																																						
Southern Belle																																						

*Self compatible and generally at least semi-compatible with most cultivars **Dependent on area and time of flowering

Tables provided by Provar. The typing of *S*-alleles of plum cultivars is an initiative of independent evaluation company Provar. Provar partnered with plant and pathogen genomics service provider Cengen. Cengen performed the molecular analyses for this project. Inputs were also received from industry technical advisers.

Provar
Independent Cultivar Evaluation
IN ASSOCIATION WITH
cengen

Table Key:

- Self-compatible
- Genetically compatible
- Genetically compatible and commonly recommended cross-pollinator
- Genetically compatible and commonly recommended cross-pollinator with a secondary pollinator
- † Untested, but commonly recommended cross-pollinator
- † Untested, but commonly recommended cross-pollinator with a secondary pollinator
- Genetically incompatible, not recommended as cross-pollinator
- Untested, genetic relationship unknown

Cultivar selection is therefore a critical factor in optimising fruit set.

Naive bees will work on plums when hives are first introduced. The bees will stop working on the plum blossoms if they are able to identify a better food source. Growers tend to introduce bee hives too early — at 10% full bloom — which compels the bees to shift to alternate flowers. Introduce half of the hives at 30% full bloom and the rest at 90% full bloom.

Bringing in waves of new hives every seven to ten days can increase pollination success and should be considered for cultivars that are especially unappealing. Attempting to flood the area with bees by increasing the number of hives per hectare is less effective than introducing multiple waves of naive bees.

Bees fly down rows rather than between them. Align hives with the heads of rows and place them at least a hundred metres away so that bees can fan out and go down many of the rows. Bees explore fewer rows when the hives are too close to the trees.

Nets are detrimental to bees because they block the ultraviolet light by which the bees navigate. Bees tend to become lost and die under nets. The best practice is to have retractable nets that can be pulled back while the bees are working. There should be little danger of wind damage if the nets are closed as soon as fruit set occurs.

Avoid placing hives under fixed nets. Rather put the hives approximately a hundred metres away and allow the bees to fly in voluntarily. Align the hives with the openings in the nets. Bees will not fly long distances under nets — continuous covered areas should ideally be no wider than 300 metres with bee access from both sides. Install nets as high as possible to reduce the impact on the bees.

Bees work better when they are not stressed. Place their hives in a warm sheltered spot where they will not be disturbed by people or machinery. Keep in mind that they do not like wind or wet and that their productivity drops under extreme temperatures.

3. Flower power

The size and quality of the harvest is directly related to flower quality. Better quality flowers have longer effective pollination periods — their ovules live longer so have a wider window during which they can be fertilised. Better quality flowers also tend to yield larger fruit.

Flower formation starts in the summer of the previous year. Anything that causes low reserves during the many months of flower development will affect flower quality. Poor flowering in one season can encourage excessive vegetative growth which will adversely affect bud development and thus flowering in the following year. So depletion of reserves can impact fruit set for more than one season.

Beware of overcropping especially in young trees. Keep up irrigation and pest and disease control post harvest. Fertilise after vegetative growth has stopped for at least two weeks — sufficient nitrogen is key to keeping trees in leaf as well as to supporting new growth in spring. Remember that the tree will accumulate more reserves the longer it stays in leaf. Early leaf-drop can be detrimental to flower quality the following spring.

The ovaries and pollen are the last parts of flowers to take shape. A heat wave around the time of flowering can prevent sexual maturation and lead to fruit-set failure. Some growers have successfully used evaporative cooling to mitigate the impact of high temperatures on buds and flowers. Implementation of this technology may be limited by water shortages or deficient water quality.

4. Orchard management

Plum blossoms usually open before leaf growth starts. Cultivars with a high chill requirement are more likely to have simultaneous flowering and vegetative growth which increases competition and can reduce set. The problem may be exacerbated by rest-breaking agents.

Cutting away one-year-old wood — making the so-called ring cut — can improve fruit set by reducing the dominating effect of the more distal buds. Ring cuts must be performed before flowering. Pinching out the tips of new shoots will also reduce competition with fruitlets.

Trees under nets benefit from the removal of nets after harvest. Increased light levels promote the development of buds and maximise accumulation of reserves.

MOST COMMONLY RECOMMENDED CROSS-POLLINATOR ACCOUNTING FOR FLOWERING TIME AND COLD UNITS

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African Delight	**Pioneer**
African Rose	**Self-compatible**
Afrigold	**Sun Supreme**
Fortune	**Souvenir** or **Ruby Crunch**
Laetitia	**Songold**
Larry Anne	**Laetitia** or **Songold**
Pioneer	**Self-compatible**
Purple Majesty	**Harry Pickstone and Ruby Nell**
Ruby Crunch	**Fortune**
Ruby Star	**Southern Belle** or **Songold**
Ruby Sun	**Harry Pickstone**
Sapphire	**Harry Pickstone**
Songold	**Laetitia**
Southern Belle	**Songold** or **Ruby Star**
Sun Breeze	**Either SunKiss** or **Harry Pickstone**
Sun Supreme	**Laetitia**
SunKiss	Either **Sapphire** or **Harry Pickstone**
Suplum 6 (Angeleno)**	**Harry Pickstone** AND either **Fortune or Souvenir****

**depends on area and time of flowering

5. Cultivar selection

Flower quality and effective pollination period are influenced by genetics. Management can improve flower quality and extend effective pollination period but the best husbandry in the world cannot enhance performance beyond the genetic potential of the cultivar. Cultivar selection is therefore a critical factor in optimising fruit set.

Cultivars that have high chill requirements may struggle with fruit set in warmer areas due to shifting and extended flowering times as well as early leaf development relative to flowering.

Cultivars that flower earlier may be better positioned to escape the impact of high spring temperatures.

Japanese plums — especially certain cultivars — are not attractive to bees. Cultivars that produce more nectar and nectar with a greater sugar content are likely to enjoy better pollination and fruit set.

The effective pollination period of most Japanese plums is not known. Future selection and evaluation of cultivars must include effective pollination period and adaptability so that growers have accurate information on which to base their planting decisions.