Management inputs and *spur behaviour*

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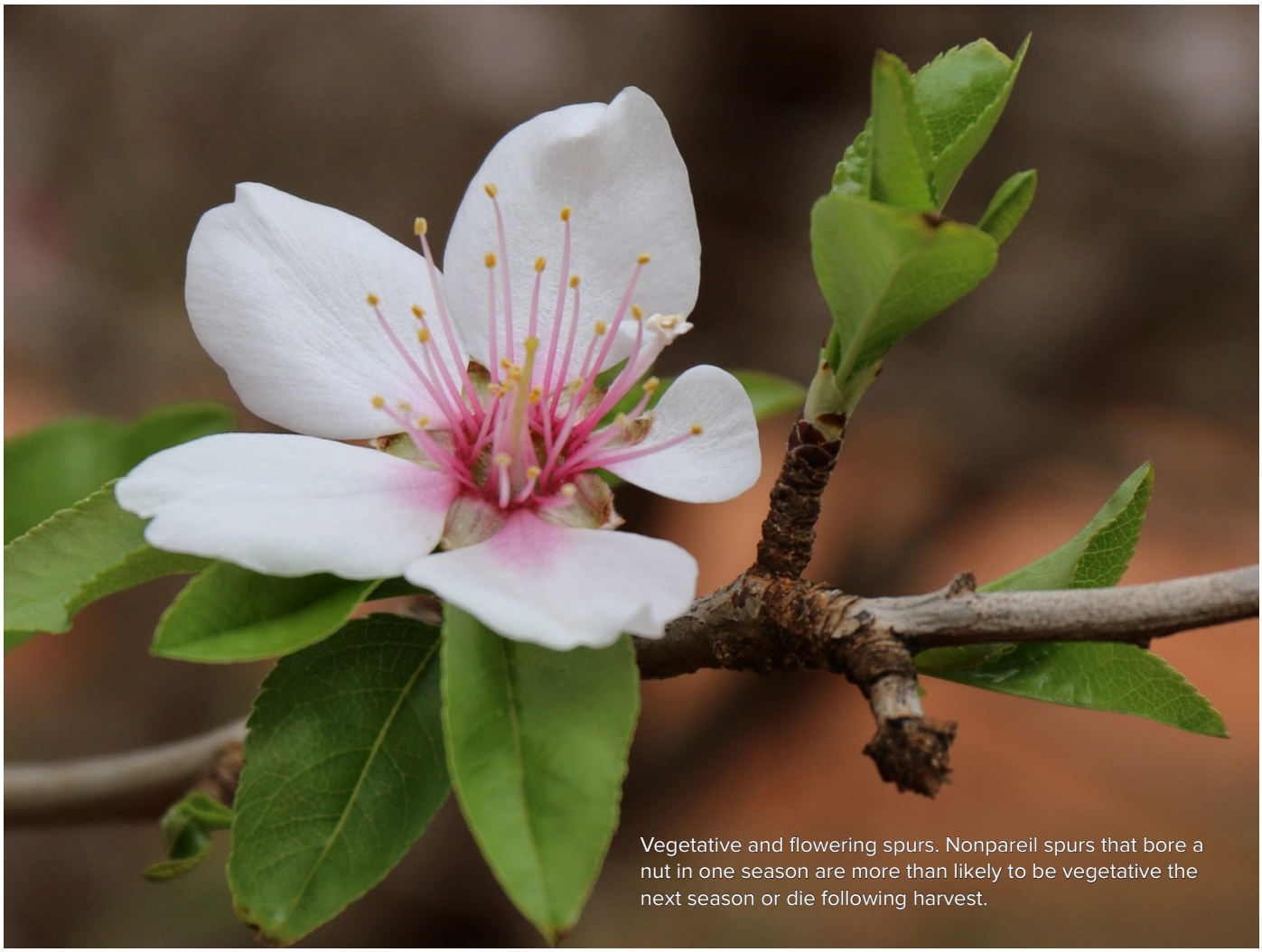
Agriculture Victoria

The Australian almond industry is interested in season-to-season crop size variability, and improving productivity. This prompted an investigation by Agriculture Victoria into the influence of key management inputs on the potential size of an almond crop, and the size of the final crop harvested. The trial was conducted on a commercial orchard at Lindsay Point in north west Victoria.

The difference between potential crop size and the actual crop size can be quite large and not always predictable, hence the interest in investigating why there are differences from one season to the next and how management inputs affect these differences. This may allow almond producers to steadily improve productivity and produce more-or-less consistent yields.

The final almond crop size is measured as tonnes of kernels per hectare and is simply the product of the number of kernels and the average kernel weight. The potential number of kernels is determined by the number of flowers but the final yield by the total number of flowers that are successfully pollinated and that set and retain fruit. So, to increase productivity spur fertility, pollination, fruit set, retention and spur longevity need to be improved.

Observations of Nonpareil and Carmel spur fertility and vitality were conducted for five seasons from 2015 to 2019. Spurs are the main fruit bearing structures on almond trees; spur fertility and longevity are obviously critical factors. In general there are thousands of spurs per tree and counting them is impossible. Therefore a sub-set of tagged spurs were followed to determine overall spur behaviour. Spur numbers per tree were inferred from the number of kernels harvested per tree, and



Vegetative and flowering spurs. Nonpareil spurs that bore a nut in one season are more than likely to be vegetative the next season or die following harvest.

the average number of nuts/spur and the proportion of vegetative versus reproductive spurs using the sub-set of tagged spurs.

Nonpareil spurs were highly fruitful, but Nonpareil spurs that carried fruit through to harvest were unlikely to survive through to the next season, and if they did, they almost certainly weren't fruitful. On the other hand, although Carmel spurs were less fruitful, the rate of spur mortality was low irrespective of the fruit load, and survival into the next season was far more likely. The rate of spur death and spur appearance must be more-or-less in balance or higher to maintain yields. Knowing how to encourage new spurs to appear would be a great help in the development and improvement of current and future production systems.

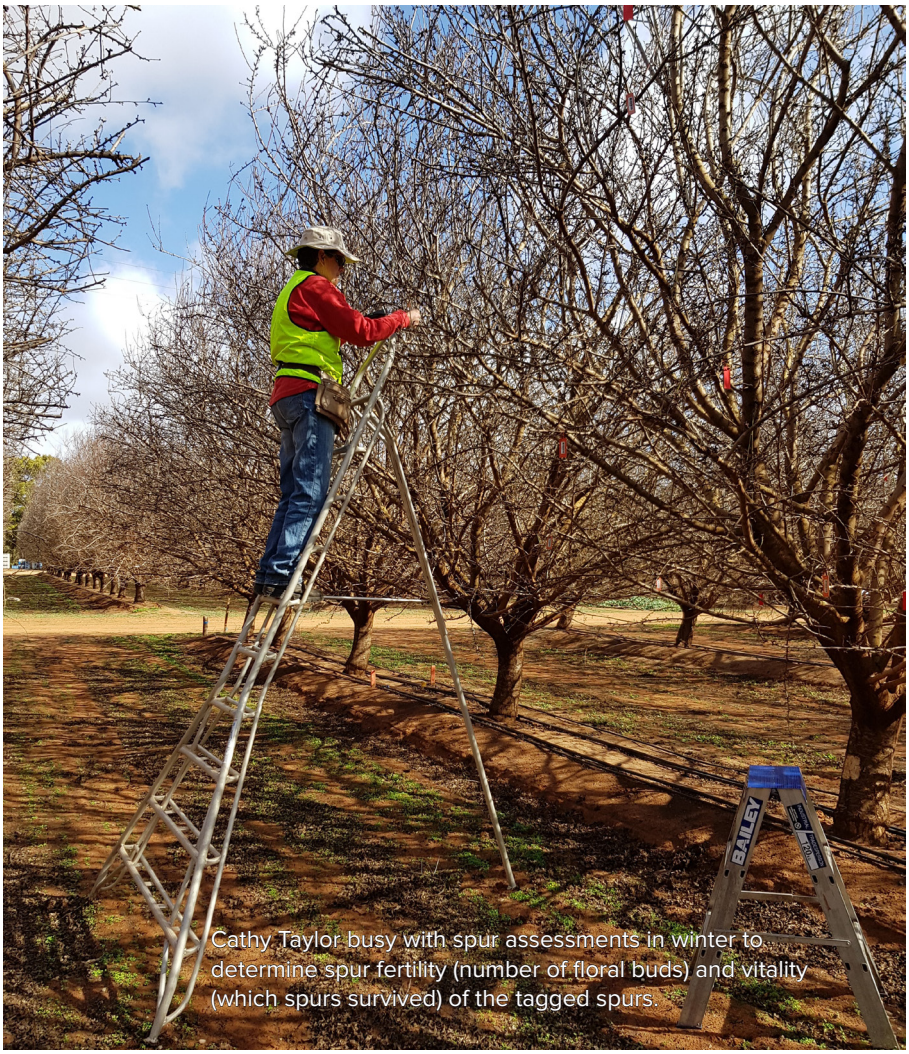
Spur productivity and turnover were also strongly influenced by spur location on the tree and the amount of light that reached these parts. Spurs high in the canopy were more fruitful than spurs lower in the canopy. The rate of spur mortality was also lower in the upper locations of trees relative to spurs located lower down. These relationships were stronger for Carmel than Nonpareil trees, which potentially explains why Nonpareil is prone to lower limb dieback.

The effects on spur behaviour of two critical and costly inputs, namely water and nitrogen, were investigated over four seasons from 2016 to 2019 as part of the project. The importance of water and nitrogen in almond production has been demonstrated by work in California (Muhammad et al., 2015) and trials at Lake Powell (Sommer and Monks, 2014) showing that 30 percent and 46 percent sustained reductions of water and nitrogen supply, respectively, did not debilitate trees. Reducing the volume of irrigation water applied to the trees at Lindsay Point from the industry standard of around 14 to 10 ML/ha/season, and the standard nitrogen supply from 300 to 160 kg/ha/season did not result in significant yield reductions in either Nonpareil or Carmel over the course of the experiment. Less water was also needed to produce a kilogram of kernels so water use efficiency was higher.

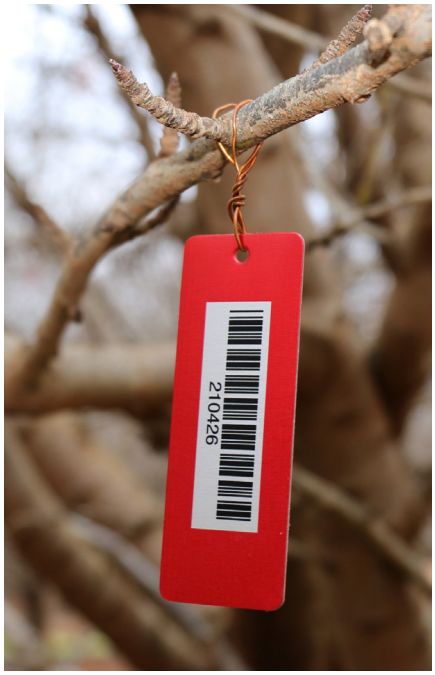
Look for the project's final report (AL14005 - Identifying factors that influence spur productivity in almonds) on Hort Innovation's website.

Acknowledgements

CMV's Lindsay Point site for allowing the establishment of the trial and the modification of the site's irrigation system as well as their patience, flexibility and assistance. The ABA's Josh Fielke and Ben Wiblin (previously Brett Rosenzweig) for providing access to the ABA's nut processing and weighing equipment. This project was possible because of the co-investments of the State Government of Victoria, levy payers and the Commonwealth Government and was managed by Hort Innovation.



Cathy Taylor busy with spur assessments in winter to determine spur fertility (number of floral buds) and vitality (which spurs survived) of the tagged spurs.



Tagged dormant spur. More than 1,000 spurs were tagged and their behaviour followed over multiple seasons if possible. Finding tagged spurs when the trees were in full leaf was challenging!