

Profile of a horticulturist: An interview with ornamental plant breeder Dr Keith Hammett

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The following article is based on an interview with Dr Keith Richard William Hammett (Fig. 1) held by Radio New Zealand Nine to Noon's host Kathryn Ryan on 23 April 2012. We thank Radio New Zealand for permission to adapt their content as an edited transcript.

The full and original interview can be heard on the Radio New Zealand website at www.radionz.co.nz/national/programmes/ninetonoon/audio/2516600/feature-guest-dr-keith-hammett.



Fig. 1 Dr Keith Hammett with his sweet peas. Photo: Dr Noel Dawson.

Kathryn: Our next guest is an eminent plant breeder, Aucklander Keith Hammett, a professional, private breeder of ornamental plants. Keith's work is best known among aficionados for his sweet pea crosses and new hybrids of dahlias, dianthus and clivia; many are found in New Zealanders' gardens, with Keith's breeding resulting in more brilliantly coloured plants, particularly in dahlias and sweet peas.

His breakthrough success with tree dahlias achieved what breeders over 100 years of trying have failed to do. Keith Hammett, who was previously a scientist with the then Department of Scientific and Industrial Research (DSIR), has focussed much of his work on the study of the species but the challenges of plant breeding go well beyond the science.

I spoke to Keith Hammett recently and asked him exactly what ornamental horticulture is.

Keith: Basically ornamental horticulture is working with plants which we grow primarily for their beauty as opposed to things we eat, wear or live in. So, they're amenity plants; things we have around to make us feel better.

Kathryn: The aesthetic value, the pleasure?

Keith: Yes, absolutely, and I see it as an art form. It just happens that if you breed ornamental plants you're using plants as a medium in the same way that a painter uses paints or a sculptor may use stone or metal.

Kathryn: How do you use them? Artistically, how do you use them to create beautiful things?

Keith: Well, the first thing to remember is that you need a goal. You have to think that you can improve a plant in some way, which is in a degree arrogant. I often think the wild plants which have evolved over millions of years are inherently very beautiful in themselves but we use them as a means of artistic expression and a very important point to remember is that we're not Gods; we don't actually create anything. We're really like builders; we put elements together to build a whole.

So, if I have got an idea that I want to produce a plant with particular characteristics I will look for existing plants which have those characters and then I seek to cross those to bring them together.

Kathryn: It's not as simple, I imagine, as seeing A and B and getting C; it is far more complicated. Do you learn over time what characteristics will be brought forth by the cross-breeding, if I can put it that way?

Keith: Yes, experience is extremely important, but you have to remember that each plant has its own particular breeding system. I was fortunate as a teenager, when I became interested in horticulture, to start with dahlias and sweet peas.

Now, in terms of breeding they are at the opposite end of the spectrum because sweet peas actually pollinate themselves a couple of days before the flower is open. Anything that you learned at school about bees pollinating sweet peas is wrong, they've already been pollinated by the time the flower is open, and the dahlia is at the opposite end of the spectrum in that it cannot pollinate itself. It has to be out-crossed with another dahlia and all the plants I have bred subsequently have fallen somewhere between those two extremes.

So, the first thing that you have to do is to understand the breeding system of the plant

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Fig. 2 Z5 96/02, an early *Lathyrus odoratus* × *L. belinensis* hybrid. **A**, hybrid in flower. **B**, close-up of flower showing very distinct vein pigmentation. Photos: Keith Hammett.

that you want to work with. There's surprisingly little in the literature, most often you have to look for yourself and work out the basic principles of what is happening.

Kathryn: Not only that, if we choose the sweet pea – which has been highly successful for you – you learn even more about its particular characteristics and if you are trying to make certain things happen in a new generation, how do you go about that? Whether it's colour or some other kind of distinctive element?

Keith: The sweet pea is often thought to have been something that Gregor Mendel worked on. Mendel actually worked on culinary peas, but more than 100 years ago geneticists in Britain used the sweet pea as a guinea pig to test Mendel's findings, which had been lost for about 30 years because they were published in an obscure German publication.

Because they pollinate themselves the cultivars that we buy are true breeding. If you sow a packet of red sweet peas and they're tall and they have long stems you expect all the plants in that seed line to be red, tall and have long stems. So, you're working with pure breeding lines.

When you cross them together, in the first (F_1) generation the characteristics are intermediate between the parents, and things don't really get interesting until the second (F_2) generation when all those characteristics re-arrange themselves in different combinations. Then you look for the plants in that population that you had set your goal upon and save seed from those because they're self pollinating, then grow them out in subsequent years.

Some of those selections will breed true, if you're very lucky. Some of them you have to persist with for quite a number of years before you can get the lines to fix again.

Kathryn: There's some sweet peas that you have bred that are attracting a lot of attention, with different flower colours (Fig. 2A–B, 3A–C).

Keith: With the help of Professor Brian Murray at Auckland University, we've investigated other species of *Lathyrus*, which is the genus to which sweet pea belongs, *Lathyrus odoratus*. Many genera, or species within other genera, cross with each other. For example, many rose cultivars are combinations of quite a few different species so they have brought in characteristics from the other species. Within the genus *Lathyrus* there are major barriers to breeding. Now, the Holy Grail of sweet pea breeding has been to produce a yellow sweet pea, in the same way as rose breeders have sought a blue rose and dahlia breeders have wanted a blue dahlia. Although sweet pea growers have always wanted a yellow sweet pea, the colour doesn't exist in the gene pool of that species. However, there are other species of *Lathyrus* which are yellow so I sought those out. In some cases it took me 12 years to actually access seed material with which to work and then we investigated the barriers that were stopping the hybridisation to take place.

What we found was that you could pollinate and you would get an embryo formed but the tissue which feeds that embryo broke down. So, what we were able to do is let the embryo develop as far as it could before the food reserves ran out and then go in and rescue that embryo by growing it in tissue culture and creating a whole plant from that, and that enabled us to make the crossover.

Kathryn: This is extraordinary skill that we're hearing and you've made a commercial career out of. I know that you've had royalties from Europe and South Africa, the US, from Japan; this is your intellectual property. It began back how far? I know there was a big garden and workplace in Auckland, out in what used to be the rural suburb of Massey, and over time have you just built the business and built your reputation?

Keith: Well, I'm first and foremost a scientist. I came to New Zealand in 1967, having trained as a plant pathologist, and I worked with the Department of Scientific and Industrial Research (DSIR) up until the early 1980s when it was transformed into a Crown Research Institute. During that time, as a hobby, I continued breeding plants – which I had actually started as a teenager while I was in England – and I brought some of the scientific knowledge that I had into the breeding, and over time I changed from being a pathologist with the government.

Horticulture took off in the early 1980s and the DSIR re-arranged some of its divisions and at that time I moved into the horticulture division and became a new crop specialist. One of the crops that we thought had high potential was the pepino and in starting to breed that I forged links with Auckland University and worked closely, as I say, with Brian Murray who is a cytogeneticist.

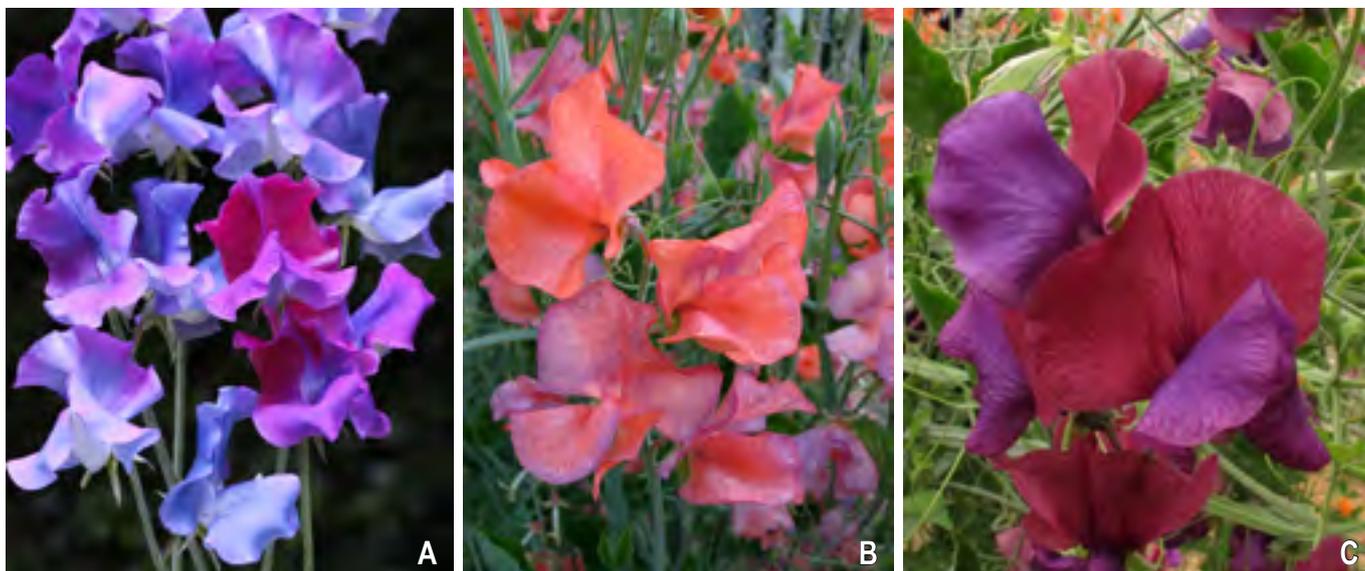


Fig. 3 Sweet pea (*Lathyrus*) selections that have inherited vein pigmentation characteristics in later breeding. **A**, *L.* 'Blue Shift', where the vein pigmentation intensifies to intense blue and ultramarine colours as the blooms age. **B**, *L.* 'Blue Vein', which also has an intensification of pigment as the blooms age. **C**, *L.* 'Porlock'. Photos: Keith Hammett.

As a consequence, we have had a succession of MSc and PhD students working on topics that I have suggested.

Kathryn: Another grower has described your dahlia, 'Magenta Star', as the dahlia of the century; is it one of which you are particularly proud?

Keith: Yes, I'm proud of anything that gives people pleasure. I think that anyone would be proud and take satisfaction from achieving one's goal, but you do realise that nothing is perfect and by that time anyhow you've set new goals. I always like the analogy that is said about people who design cars that, when the designer of a specific car is sitting at the traffic lights and his latest release draws up alongside him it should look old-fashioned.

Kathryn: Speaking of the dahlias, if we stay with that story, it was 1980 in Mexico I think where you had what might be called an epiphany that was to lead you in a direction with them. What was it about what you saw in Mexico?

Keith: Well, I got into horticulture at the competitive hobby level. I joined the local horticultural society as a teenager and it was unusual for a teenager to join a horticultural society, even at that time. It was immediately after the Second World War and ornamental horticulture was extraordinarily popular throughout the western world because it was a reaction to the previous awful five years of killing.

The society that I belonged to was in the suburbs of London and contained many national exhibitors who grew to a very high standard. They mentored me and I soon learned to grow dahlias for show. So, probably for the first 20 years or so I was aiming to produce the sorts of dahlias which would win on the show bench.

Then I realised that there were another 30-odd species of dahlias which were hardly known in cultivation, if at all, so I went to Mexico and travelled with a botanist and saw them growing where they had evolved over millions of years. It was a remarkable experience and I couldn't help thinking how inherently beautiful they were. It changed my whole direction so that, instead of producing 'footballs on sticks' which the exhibitors love – and which I still judge quite happily – I set out to produce a completely different sort of dahlia (Fig. 4). I sought those that were more graceful and didn't require a great deal of support in the garden. In fact the exhibitors don't show with the leaves at all, so they're ignoring half of the plant, and I realised that the foliage itself offered a great deal of inherent beauty. You can have green foliage, you can have it bronze, you can have the leaves entire or they can be divided. So, there was a whole area that dahlia breeders had been ignoring and that was when I set different goals.



Fig. 4 *Dahlia* 'Home Run', a hybrid between *Dahlia coccinea* and *D. australis*. Genes from *D. australis* had not previously been introduced into the cultivated *Dahlia* gene pool. Photo: Keith Hammett.

Kathryn: How interesting that you'd seen them in their wild forms – you, whose passion was breeding and making hybrids – you saw them in their uncrossed forms and that was what gave you a whole, different creative direction.

Keith: Yes, it completely altered my paradigm.

Kathryn: You've said previously that New Zealand had the potential to become the Holland of the South Pacific. How is the country doing, however, in developing ornamental horticulture?

Keith: Yes, I said that 25 years ago and I was immensely hopeful at that time but subsequently government decisions – probably made with the best of intentions – have actually made that totally impossible. As I have said to you, plant breeders don't actually create anything; we put together components and to do that we need a big collection of plants – a gene pool – in which we can dip. The biosecurity regulations changed so that any plant species which wasn't on a list known to be in New Zealand you couldn't bring in unless you went through an elaborate process with an outfit which was called ERMA, they're called EPA now – the Environmental Protection Agency. If you made an application to bring in a species which wasn't known to be here you had to put up something like \$30,000 to start with in order to make the application, and in practice you'd had to do most of the research to provide the data anyhow. So, it simply made it impossible to bring something into the country which wasn't known to be here. It's aggravated by the fact that the list probably only contains half, or at best two-thirds, of the plants which are already here, but simply aren't on the list.

Kathryn: So, these tough biosecurity laws have had a real impact on breeders over recent years, and whatever their good intentions have potentially stifled the ornamental industry?

Keith: In terms of innovation, yes. You can bring in lots of pansies for example, lots of selections which have been bred overseas but, in the same way that I've been able to bring two species together in the sweet pea, I wouldn't now be able to get that second species in because it isn't on the list.

So, real innovation is being stifled and you have to realise that we would need to bring in a lot of plants, and probably only a small proportion of which would actually be of any use, but you have to bring them in and screen them to see if they have any potential. That is where the problem lies.

Kathryn: It's more than politics – with the PSA outbreak among kiwifruit in New Zealand and lots of questions over whether the border security was perhaps not tough enough, but there seems to be a lot of matters about what you're doing that could provide constraints.

For example, with the sweet pea what you achieved in creating that particular hybrid we were talking about earlier has been done without genetic engineering; it has been done through your own skills. The fact that it doesn't use GE doesn't necessarily make you any more popular though, does it? Are there sensitivities around that as well?

Keith: I've not encountered any sensitivities and I want to make it clear that the cytogenetic skills lie with Brian Murray at Auckland University. I'm a practical plant breeder and don't have the specific cytogenetic skills. So, we very much need teamwork from people who've got disparate skills and it's also important to remember that once I have produced something which has commercial potential it requires a whole team of people to actually get that to the market worldwide. So, the breeder is in an interesting situation, and sits at a mid-point where they have to have the ability to look into what's available scientifically and technically but also have to have an understanding of the commercial world and the networks.

Kathryn: Indeed, there are many in your own network, many organisations, including public organisations. What I'm getting at is, in the corporate world internationally, there is a lot to be gained – and again we can look beyond the ornamental area – by patenting of genes and by gaining monopoly in intellectual property rights. Is that something that you're rubbing up against as well? Or is that something that you are observing perhaps?

Keith: Philosophically there's an important point that the whole concept of patenting dates back to England several centuries ago. The idea was that if you invented something you were given a monopoly for a period of about 20 years. You had to fully disclose what the details of that invention were, so that when that monopoly expired other people could make it, and I think that's entirely reasonable. I think if someone writes a novel they're entitled to royalties for a period; if someone composes a piece of music they are doing the same as I am, they are putting together notes in the same way as I am putting genes together.

The real distinction is that you are being rewarded for the combination of characters that you put together. The concept of patenting a gene is comparable to saying, "I'm going to patent the C sharp, if anybody else uses the C sharp in their composition they have to pay me a royalty" and that to me is totally anathema because a C sharp is something which occurs naturally in the world; no one has done anything about creating it.

Kathryn: Some of this is happening, but it is very controversial. Is it happening more in the area of food production rather than the ornamental side of things?

Keith: Yes, when you talk about the corporate world, corporations are comparable to totalitarian governments. What they seek is total control and a monopoly. A classic case probably is Monsanto and Roundup™. Roundup is a very effective herbicide, glyphosate, and it was under the patent system; it had its 20-odd years of life. They are a chemical company who moved into genetic engineering and what they've been able to do is to insert a gene which gives resistance to a whole range of crops so that they can be sprayed overhead with Roundup to control weeds of those crops, but their motivation was purely and simply to create a monopoly and maximise profit.

Kathryn: You, ironically, as a professional plant breeder, and part of a team that does this, are in a situation where your legitimate intellectual property is being ripped off; illegal cultivating is alive and well.

Keith: Well, I can take plant variety protection rights, but because the legislation is confined to each specific country, if I want to protect something of mine I've not only got to take it in New Zealand, I have to do it in Australia, North America, Europe and other countries, so it is an immensely costly business. But understand one thing, I have no objection to anybody using one of my cultivars to cross with something else and make further hybrids. That is the whole essence of the plant variety rights scheme which is distinct from patenting.

Kathryn: What determines whether or not – or what new plants you will breed?

Keith: I guess in my case I've got the luxury that because I'm an independent sole trader I can choose to breed what I wish. The plants that I work on, I've worked on traditionally all my life because they appealed to me. If I were working with a company I would be told what was required and I'd have less freedom and probably shorter timeframes to work within.

Some things I breed I know are not commercial and will simply breed them as a hobby because I've chosen to do so. I have bred other plants because nurseries have come to me and have asked me to breed for them.

Kathryn: Over the decades that you have been plant breeding and developing your skills, how has the practice changed?

Keith: The practice of breeding itself hasn't really changed for centuries, but we know much more about what we're doing now. You have to remember that all the domestic breeds of dogs, cattle and so on were developed by

practical breeders intuitively long before the term 'genetics' was even coined or we had understanding of what was underlying it.

In terms of commercialisation, the horticultural retail trade has really gone down the supermarket model where stock is bought primarily on impulse. You've only got to go to a garden centre and see people pushing their trolleys around and seeing something they like the look of – it takes their fancy and they put it in – but none of the plants relate to each other and I notice this in Britain particularly.

There's no country which is keener on its gardens than Britain and when I was over there last summer, I saw people buying that way at the garden centres. Then you'd look at half the gardens and they were like a ruddy cake, you know, with a bit of decoration – plants sitting here and there like baubles.

There was no sense of aesthetics and that has been the problem; there has been a general dumbing down in horticulture. In simpler times gardening was actually a major recreational activity. Dad would grow vegetables in the back garden and would know how to do it and mum would probably grow flowers in the front garden, and the kids grew up knowing when to plant seed, how to take cuttings and so on. There was a relatively higher level of horticultural knowledge.

That has largely disappeared and, as I say, plants now are produced to look good at the point of sale. If you try and sell a dahlia tuber, people would look at the brown, slightly shrivelled-looking thing and would want instant gratification instead. What they don't realise is that they miss out on the actual joy and satisfaction of growing the plant. If you put that tuber in the ground you have the pleasure of seeing the shoots come up and then the plant develops leaves and goes on to produce flowers, and you have a sense of satisfaction.

We used to buy bedding plants as green seedlings; they'd probably be wrapped up in newspaper and then people would take them home and plant them out. They would then have the pleasure of seeing them develop. Now, people go into a garden centre, buy the finished product, plonk it in the ground, and the only position it has got is to go backwards after that. To me the analogy is that it's a bit like a mountaineer getting a lift to the top of the mountain in a helicopter; the view is great but there isn't a huge sense of satisfaction.

Dr Keith Hammett is a long-standing member of the RNZIH and joined in 1982. He received the Plant Raisers' Award in 1988 and was made an Associate of Honour (AHRH) in 1994.