

The Role of Diet in CANARY COLOUR

Part 2

RED FACTOR CANARIES

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In Part 1 of this article we saw how yellow canaries utilise a combination of selective genetic traits as well as specific carotenoids in their diet to produce their bright yellow plumage. Carotenoids are important chemical compounds in the diet that may be utilised or modified in the bird's body to produce yellow, orange or red pigments in the feather.

It was apparent however, through centuries of selective breeding, that normal canaries were not genetically capable of displaying red in their plumage. Some colour enhancement was achieved through 'colour feeding'—adding specific components to the diet in order to affect plumage colour (Figure 1). This was recorded as early as the 1870s when fanciers in England fed red peppers to Norwich Canaries. This transformed the yellow canaries to orange because of the carotenoid capsanthin present in the peppers (it is also in chillies and paprika). However, no matter how much red pepper was fed, the birds remained a shade of orange rather than a genuine red.

Canary-Red Hooded Siskin Hybrid

It was in the 1920s that fanciers in Germany came up with a concept to breed red-coloured canaries. This was attempted by crossing the clear-type yellow canaries with the small South American Red Hooded Siskin *Carduelis cucullata*. (See Figure 2.)

The male Red Hooded Siskin was well known for its striking fire-engine red colour, and it was hoped that the canary x siskin hybrids would carry the genetics for red plumage. The hybrid offspring were repeatedly back-crossed with canaries to remove virtually all the siskin genes, except those for producing red feather colouration. Technically, this was the first ever attempt at genetic engineering—the selective incorporation of one species' genes into another's.

However, the initial results of the siskin cross-breeding



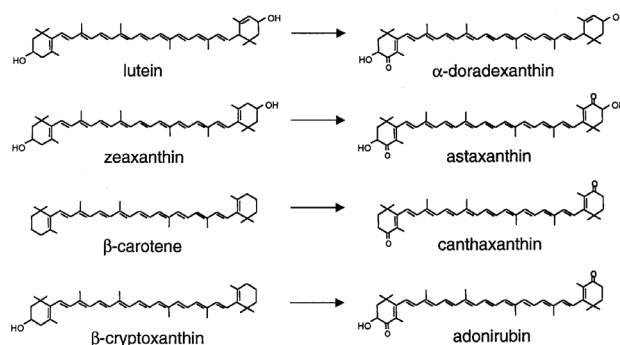
Figure 2—Male Red Hooded Siskins were hybridised with canaries to produce offspring with genes for red colouration



Figure 1—This bird displays some orange feathers as a result of colour feeding

experiments were very disappointing. Firstly, there were very few fertile young produced but, more importantly, the colours produced came nothing close to that of the brilliant siskin. Some birds produced a deeper burnt-orange or coppery colouration, but there were no truly Red Factor Canaries as we know them today. What these early breeders failed to realise was that the red colouration they sought was not just a genetic trait from the siskin but also required a dietary component—specific carotenoids, capable of producing red colour.

With hindsight, this may seem obvious to us today, as even the Red Hooded Siskin is prone to colour loss when maintained on



inadequate diets in captivity (see Figure 3).

It wasn't until the 1960s when breeders in England started to colour feed with a product called Carophyll—a red carotenoid concentrate used in the poultry industry—that they started to achieve the true Red Factor Canaries that we see today (Figure 4).

Colour in Red Factor Canaries

As we have seen previously, the carotenoid component of a canary's colour must come from its diet. The most commonly found carotenoids in the feathers of Red Factor Canaries are, not surprisingly, the same as those found in the Red Hooded Siskin.

These are chemically shown below in the diagram, with the dietary precursor on the left and the resultant red carotenoid in the feathers on the right.

Probably the most important component in producing the



Figure 3—Male Red Hooded Siskin displaying red colour loss due to dietary deficiency of carotenoids



Figure 4— Red Factor Canary—a combination of Red Hooded Siskin genetics and colour feeding

Table 2. Carotenoid Feed Trials with Red Factor Canaries

Diet	Total Carotenoid Content	
	In the Seed Mix	In the Breast Feathers
Control (Normal seed mix)	6mg/kg	476mg/kg
Treatment (Seed mix with added canthaxanthin)	56mg/kg	934mg/kg

Source: Brian Rich, Wombaroo/Passwell Food Products.

brilliant colour of the male siskin is canthaxanthin (pronounced *can-tha-zan-thin*) which most likely comes from the precursor carotenoid β -carotene. We are unsure as to how the siskin derives this in the wild, but it may well come from native South American plant species that contain rich sources of the red carotenoid precursors.

Diet Supplementation

Red Factor Canaries need to have a regular supply of the correct carotenoids (particularly canthaxanthin) in their diet in order to produce well-coloured feathers. If there are insufficient red carotenoids in the blood stream at the time of feather growth, the red colouration tends to fade significantly. This occurs when feeding a normal canary seed mix, due to the absence of canthaxanthin in seed.

Dietary supplementation with canthaxanthin can significantly enhance the colour of Red Factor Canaries, especially in the lead up to and during moult. It is important to note that supplementation only affects the colour of growing feathers (not existing ones) so you will not see a visible change until the next feather moult.

Our research indicates that it is most effective to supply the canthaxanthin directly to canaries in the diet rather than feeding the chemical precursor β -carotene. Some breeders may use both, but there appears no real rationale for this. In fact, the ingestion of β -carotene with canthaxanthin reduces the bioavailability of canthaxanthin.

Canthaxanthin is naturally present in some specific types of algae, fungi, and even fish, but is not readily found in the foods we usually feed to birds. Commercially, canthaxanthin is extracted from cultured bacteria as a powdered concentrate (eg Passwell Factor Red™) and usually diluted into drinking water. Some liquid preparations can be purchased in pet shops but these are often too dilute to be effective and are susceptible to inactivation by oxidation.



Figure 5—Commercially available canthaxanthin concentrate powder, used in the feed trials

Feed Trials

We have undertaken feeding trials on Red Factor Canaries to determine the value of supplementing carotenoids in their diet. We measured carotenoid levels in the seed and feathers before and after supplementing with canthaxanthin.

Results of the feed trials showed that treating the seed with canthaxanthin almost doubled the carotenoid content of the breast feathers after moulting. This resulted in significantly brighter plumage compared to birds fed exclusively on a plain seed diet.

In undertaking these trials, we were also able to develop a unique infusion process to absorb the canthaxanthin into the seed. This meant that as birds removed the seed husk, they could still readily obtain the canthaxanthin from inside the seed kernel. This has now been developed in the new product Passwell Red Factor Canary Seed™—the first commercially available canthaxanthin-enhanced canary seed mix.

We found that absorbing the canthaxanthin into the seed diet was more effective than adding it to drinking water. This is because there is considerable variation in the daily intake of water by birds due to fluctuations in temperature, moisture content of diet and activity levels. In the past, breeders have tended to overdose the water with canthaxanthin to ensure sufficient intake. This often resulted in birds having bright red droppings, a clear indication of excess consumption of the carotenoid. This was a wasteful practice given the high cost of purified canthaxanthin. In addition, excessive supplementation can impact negatively on the retina of the eye and reduce the vitamin E distribution in liver and adipose tissue.