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Review of beak-trimming methods

A report for the Rural Industries Research and Development Corporation

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Foreword

Beak-trimming is commonly performed in the commercial egg industry in order to prevent injury and mortality in pullets from aggressive pecking and cannibalism. If birds are not trimmed mortality of up to 25-30% will occur.

However welfare groups have expressed concern that beak-trimming may lead to unnecessary pain and loss of sensory function. It is possible to rear pullets without beak trimming if there is effective light control. However the majority of commercial poultry sheds in Australia are open to natural light and once an outbreak of cannibalism has occurred it is difficult to control. Under some conditions it might be possible to manage laying hens without beak-trimming, but for most producers the risk of such a policy is too high.

There have been substantial genetic studies, which have shown there is potential for commercial breeders to develop strains of birds, which are not aggressive and hence do not need to be beak-trimmed. In the interim, however, as the beak-trimming procedure faces increased welfare scrutiny, there is a need to develop quality assurance guidelines to ensure beak-trimming is conducted consistently and effectively with minimal welfare effects on birds.

There has been little change to the method of beak-trimming since it was first developed fifty years ago. New technology methods of beak-trimming have been introduced to the Industry, but with limited success.

This review was undertaken to obtain information on the range of beak-trimming methods available or under development. To resolve the key issues associated with beak-trimming a research and development plan has been recommended to; i) ensure consistent and effective beak-trimming, ii) establish high technology beak-trimming methods, iii) improve technology transfer and iv) develop a beak-trimming accreditation system for operators.

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Executive Summary

A review was undertaken to obtain information on the range of beak-trimming methods available or under development. Beak-trimming of commercial layer replacement pullets is a common yet critical management tool that can affect the performance for the life of the flock. The most obvious advantage of beak-trimming is a reduction in cannibalism although the extent of the reduction in cannibalism depends on the strain, season, and type of housing, flock health and other factors. Beak-trimming also improves feed conversion by reducing food wastage. A further advantage of beak-trimming is a reduction in the chronic stress associated with dominance interactions in the flock. Beak-trimming of birds at 7-10 days is favoured by Industry but research over last 10 years has shown that beak-trimming at day-old causes the least stress on birds and efforts are needed to encourage Industry to adopt the practice of beak-trimming birds at day-old.

Consultation with experienced beak-trim operators in Australia revealed that the main problems being faced with the practice are achieving appropriate beak length and shape of beak to minimise further pecking. Operators report variations in beak hardness, bleeding of beaks following trimming, and a lack of experienced well trained personal to conduct the operation.

Proper beak-trimming can result in greatly improved layer performance but improper beak-trimming can ruin an other wise good flock of hens. Re-trimming is practiced in most flocks, although there are some flocks that only need one trimming. In Australia there is anecdotal evidence that re-trimming may not be required in many birds, but to avoid the potential problem of cannibalism as a result of beak re-growth most birds are re-trimmed at 10-14 weeks. Given the continuing welfare scrutiny of using a hot blade to cut the beak, attempts have been made to develop more welfare friendly methods of beak-trimming. The main methods which have been utilised to beak-trim birds have been as follows;

Hot blade beak-trimming

Despite the developments in design of hot blade beak-trimmers the process has remained largely unchanged. That is, a red-hot blade cuts and cauterises the beak. The variables in the process are blade temperature, cauterisation time, operator ability, severity of trimming, age of trimming, strain of bird and beak length. This method of beak-trimming is still overwhelmingly favoured in industry and there appears to be no other alternative procedures that are more effective.

Cold blade beak-trimming

Sharp secateurs have been used trim the upper beak of both layers and turkeys. Bleeding from the upper mandible ceases shortly after the operation, and despite the regrowth of the beak a reduction of cannibalism has been reported. Very few differences have been noted between behaviour and production of the hot blade and cold blade cut chickens. This method has not been used on a large scale in Industry. There are anecdotal reports of cannibalism outbreaks in birds with regrown beaks.

Robotic beak-trimming

A robotic beak-trimming machine was developed in France, which permitted simultaneous, automated beak-trimming and vaccination of day-old chicks of up to 4500 chickens per hour. Use of the machine was not successful because if the chicks were not loaded correctly they could drop off the line, receive excessive beak-trimming or very light trimming. Robotic beak-trimming was not effective if there was a variation in the weight or size of chickens.

Chemical beak-trimming

Capsaicin can cause degeneration of sensory nerves in mammals and decreases the rate of beak regrowth by its action on the sensory nerves. Capsaicin is a cheap, non-toxic substance that can be readily applied at the time of less severe beak-trimming. It suffers the disadvantage of causing an extreme burning sensation in operators who come in contact with the substance during its application to the bird. Methods of applying the substance to minimise the risk to operators of coming in contact with capsaicin need to be explored.

Laser beak-trimming

A method was reported which cuts the beaks with a laser beam in day-old chickens. No details were provided on the type of laser used, or the severity of beak-trimming, but by 16 weeks the beaks of laser trimmed birds resembled the untrimmed beaks, but without the bill tip. Feather pecking and cannibalism during the laying period were highest among the laser trimmed hens. Currently laser machines are available that are transportable and research to investigate the effectiveness of beak-trimming using ablasive and coagulative lasers used in human medicine should be explored.

Freeze drying trimming

Liquid nitrogen was used to declaw emu toes but was not effective. There was regrowth of the claws and the time and cost involved in the procedure limit the potential of using this process to beak-trim birds.

R&D plan

To resolve the key issues associated with beak-trimming a 10-year research and development plan has been recommended to;

1. Ensure consistent and effective beak-trimming,
2. Establish high technology beak-trimming methods,
3. Improve technology transfer and
4. Develop a beak-trimming accreditation system for operators

General Introduction

Beak-trimming is performed early in the life of commercial hens to decrease injuries caused by the behavioural vices of cannibalism, bullying and feather and vent pecking and to avoid feed wastage. Beak-trimming is known to help flocks with a hysteria problem. For the majority of birds beak-trimmed in the world today, it involves the partial removal of the upper and lower beak using an electrically heated blade. Without a correct beak-trimming program, the egg producer risks heavy losses of chickens and pullets from cannibalism and in the laying stage from protrusion and vent pick outs. In many cases these losses represent the major part of mortality not caused by disease. If birds are not trimmed, mortality of 25 % of the flock will occur and can cause similar financial losses as a disease outbreak.

It is possible to rear pullets without beak-trimming if there is effective light control. However once an outbreak has occurred it is difficult to control cannibalism. Under some conditions it might be possible to manage laying hens without beak-trimming, but for most producers, the risk of such a policy is too high. Bell (1996) reports that care must be taken when considering the 'no trim" form of management. He states "elimination of beak-trimming may seem to be an attractive goal but it must be done with caution and careful consideration of all the consequences".

A concern expressed by welfare groups is that beak-trimming is "a discredited mutilation and farmers who still practice it should be brought into line by law. It is a last ditch measure to avoid the consequences of bad management. If stocking densities are too high, the diet not balanced, or if lighting is at fault, stress-aggression occurs. To overcome it the beak is burned off cutting through a bed of highly sensitive nerve tissue, similar to the quick of the human finger nail".

On the other hand the prevention of cannibalism is a positive contribution to animal welfare as the pain and suffering resulting from cannibalism is much greater, resulting in the death of the bird. Many producers believe that on balance the practice of beak-trimming is to be favoured, provided that the operation is performed properly.

Decision about beak-trimming includes the age to trim, amount of beak to remove, temperature of the blade and length of time to cauterise the beak. These factors coupled with differences in beak growth characteristics have the potential to create an endless number of combinations, many of which may be harmful to the individual bird. The beak-trimming method needs to be tailored to strain. One method may work with one strain but maybe quite inadequate for another strain. In general, however, if the beak is cut near the tip of the bone, at the correct angle and blade temperature, trimming will be successful. The problem facing producers is that they are sometimes unsure of the age to trim chickens and the method to use. The following review was undertaken to provide information on the effects and best practice for trimming and re-trimming and procedures required to reduce the need for re-trimming.

Because of the continuing welfare scrutiny of the beak trimming procedure, attempts have been made by researchers to develop more welfare friendly methods. This review outlines information on the range of beak-trimming methods available or under development. Beak-

trimming is one of the most critical programs in use and extreme care must be taken to assure minimum harm to the flock, while at the same time necessary control of cannibalism. To ensure consistent and effective beak trimming in all strains of birds kept in all production systems in Australia a research and development plan has been recommended for consideration by Industry.

Objectives

1. To provide detailed information on the range of beak-trimming methods available or under development.
2. To provide information on the effects and best practice for trimming and re-trimming and procedures required to reduce the need for re-trimming.
3. To develop strategies for implementing best practice in the egg industry and recommendations and priorities for R&D.

CHAPTER I
LITERATURE REVIEW

1.1 Why are birds beak-trimmed?

Beak-trimming is performed early in the life of commercial hens to decrease injuries caused by the behavioural vices of cannibalism, bullying and feather and vent pecking and to avoid feed wastage. Beak-trimming is known to help flocks with a hysteria problem. For the majority of birds beak-trimmed in the world today, it involves the partial removal of the upper and lower beak using an electrically heated blade. Without a correct beak-trimming program, the egg producer risks heavy losses of chickens and pullets from cannibalism and in the laying stage from protrusion and vent pick outs. In many cases these losses represent the major part of mortality not caused by disease. If birds are not trimmed, mortality of up to 25-30 % of the flock will occur and can be financially as disastrous as a disease outbreak (Bolla, 1977, 1990; Glatz, 1990).

1.2 Cannibalism

1.2.1 Aetiology

Outbreaks of cannibalism are clearly recognisable. The evidence of blood stained birds, broken skin, raw wounds and injured vents which are occasionally mistaken for prolapse are all clear indicators of cannibalism. Many causes of cannibalism have been suggested. Often outbreaks occur in one pen while similar environmental conditions or feeding practices in other pens on the same farm do not cause any difficulty. Savory (1995) and Savory and Mann (1997) report that cannibalism develops either as a result of misdirected ground pecking or is associated with the dust bathing behaviour.

1.2.2 Signs of vent pecking

If a bird has died due to a pick-out in a cage, other birds in the cage may be next, usually caused by an individual bird engaging in vent pecking. In this situation all birds should be taken out of the cage and oviduct everted to examine the mucosa inside the cloaca and the lower part of the reproductive tract. It is likely that there will be damage observed, caused by the pecking bird. One or more wounds, produced by the pecking will be seen while the other hens were laying eggs on the previous day. The damage affects the muscular activity of these tissues and produces a vent prolapse a few days later.

1.2.3 Tissue picking in bare areas.

Forceful pecking is directed at bare skin leading to haemorrhage (Savory, 1995), attracting other birds to join in the pecking. Death of the pecked bird usually results.

1.2.4 Vent picking

Vent pecking appears unrelated to the tissue pecking although shares some of its features (Savory, 1995). It may be related to hormonal changes. Picking of the vent region or region of the abdomen several inches below the vent is the severest form of cannibalism. Predisposing conditions are prolapses or tearing of the tissues by passage of an abnormally large egg. Alternatively pecking may be directed at the small downy feathers below the cloaca. After birds have tasted blood they will continue their cannibalistic habits without provocation. Cannibalistic pecking is responsible for at least 80% of all vent prolapse cases (Smith, 1982) and often results from poor beak-trimming with the offender usually being a cage mate or a bird in an adjacent cage that has been improperly beak-trimmed. The true prolapse is a condition that occurs during the first stages of lay when the pullet has suffered a rupture of the

tissues of the lower part of the reproductive tract. Usually prolapse occurs because of poor muscular elasticity or tone and may be the result of a hen's laying too large an egg for its age. Prolapse occurs where fat pullets have been put into production, where pullets have been indirectly light stimulated or where pullet's flocks have been reared non uniformly and has under developed members.

1.2.5 Feather pecking

Morgan (1987) suggests that feather pecking is the precursor of cannibalism. Naked areas appear on the bird's body especially back, tail and the vent. This is sometimes believed to be caused by feather mites or by the hen moulting. Slow feathering strains are more susceptible to feather pecking. In its mildest form it has been observed as barb pecking and ignored by the recipient. Mould growth and mycotoxins in feed can cause abnormal feathering contributing to feather pecking (Elliot, 1995). Feather abnormalities have also been attributed to deficiencies of zinc, tryptophan, lysine, glycine, leucine, arginine, valine, isoleucine, phenylalanine and tyrosine (Elliot, 1995). Dietary deficiencies of pantothenic acid, folic acid, Vitamin B12, Vitamin E, pyridoxine, and biotin also contribute to poor feathering.

1.2.6 Feather pulling

Feather pulling is most frequently seen in flocks in close confinement with lack of sufficient exercise. Nutritional and mineral deficiencies may be contributing factors. Sometimes the feather is removed and eaten. Irritation caused by lice and mites may induce this vice.

1.2.7 Toe picking

Toe picking is most commonly seen in domestic chicks and is often initiated by hunger, excessive warmth (Seetha Rama Rao, 1988) and toe trimming. It is a particularly serious vice among young chicks reared on dark coloured litter and can lead to an increase in mortality and a reduction in growth. Strong light illuminates the blood in the quick of the toes attracting the attention of the other chicks.

1.2.8 Head Picking

Head picking is directed by dominant birds at birds low in the pecking order causing the recipient to vocalise (Savory, 1995). In severe cases the areas above the eyes are black and blue with sub-cutaneous haemorrhage, wattles are dark and swollen with extravascated blood, and ear lobes are black and necrotic. Even though birds have trimmed beaks and are kept in separate cages they will reach through the wire and peck at a neighbour or grasp its ear lobe or wattles and shake their heads in much the same fashion as a terrier shaking a rat. Wood-Gush (1959) reports on breeds of birds selected for fighting in Roman times with little systematic selection against this vice occurring since then. The modern bird's aggressive behaviour may be a legacy of this approach.

1.2.9 Factors which can lead to cannibalism (anecdotal reports and published causes- critical factors shown in bold)

- **Strain**
- During periods of disturbance (vehicles and other farm noises).
- Changes in staff tending to the flock.
- Changes in diet and batches of diets.
- Feeding diets with a deficiency of calcium and protein (Ambrosen and Petersen, 1997), manganese (Kull, 1948) and arginine, zinc, salt or sulfur amino acids (Hughes and

Duncan, 1972). These deficiencies are often reflected in some neck moulting soon after peak of lay.

- March (1975) reports that feeding rapeseed meal will increase the rate of mortality in layers.
- Other dietary factors considered to predispose birds to cannibalism are **feeding only pellets**, or compressed feed, cafeteria system of feeding and excess corn in the ration.
- Rations containing a high level of wheat (Abrahamsson, *et al.* 1996) have been regarded as being conducive to cannibalism. Rations with low protein content and low vitamin B12 content may precipitate the vice.
- Atteh and Ajakiye (1993) observed higher mortality in birds fed blood meal and soybeans. It was suggested that cannibalism initiated at time of oviposition was an attempt by birds to compensate for the protein deficiency in the basal diet.
- **Restriction of feed or water, or insufficient feeder or drinker space.**
- Variable weather conditions especially during periods of thunderstorm activity.
- **During periods of high humidity and high temperature.**
- During period of low humidity less than 50% (Schonewille, 1985).
- High dust and ammonia levels.
- Presence of predators, flies and ectoparasites.
- Rough handling.
- Frequent changes in light intensity in naturally ventilated sheds caused by frequent changes in outside cloud cover.
- Variable light intensity from poor lighting layout in controlled environment housing.
- **Light leakage from inlets and outlets resulting in "torch-like" beams of light on birds feathering.**
- Colour of light that induces aggression. Risk is high when lighting is bright and or/blue and low when it is dim and or/red (Savory, 1995).
- **Attraction to reproductive tract exposed during egg laying.**
- **Injuries attracting pecking at damaged tissue.**
- **Boredom.**
- **Overcrowding.**
- **Insufficient nesting space.**
- Flock nervousness in high producing strains or over excitement.
- **Lame birds left in flock.**
- **Dead birds left in flock.**
- **Keeping different ages or birds with different feather colours together.**
- **Aggressive individual birds.**
- **Sick, weak, small, or odd coloured birds; birds will attack and kill these as a survival instinct.**
- **Feather change from fluff to feathers (Schonewille, 1985).**
- **Poor ventilation.**
- Lack or absence of properly designed nest boxes.
- Inflamed cloaca from enteritis (Neal, 1956); or bulging cloaca at onset of first egg (Schonewille, 1985).

1.2.10 Remedies to stop cannibalism

- **Beak-trimming**
- Hanging cabbages or sugar beets in the pen.
- Putting pine boughs on the floor.
- Painting windows red.
- Applying Stockholm tar to picked birds.
- Using no pick salves.
- Using repellent sprays.
- Adding salt to the feed and water.
- Feeding oats.
- Feeding vitamin preparations or including vitamin B complex in drinking water.
- Feeding DL methionine (Neal, 1956), manganese sulphate and horn meal (Kull, 1948).
- Applying Vicks Vapour rub on wound (Grigor, *et al.* 1995).
- Including DL methionine (Shaver Focus, 1982) in drinking water (1.5g/L for first 4 days; 1.0 g/L for next 3 days),
- Feeding whole grain diets (Foster and Taha, 1978).

1.3 Objections to beak-trimming

1.3.1 Welfare comments

Miller (1987) reports the purpose of beak-trimming is to limit the damage the hens can inflict on one another living in abnormally cramped quarters. In addition to causing pain to the birds beak-trimming has drawbacks from a production point of view. "A small portion of the chicks cannot simply survive the shock of the operation. The minimum-waged employees who burn tiny beaks off chicks all day are not known for their care and precision work. Inevitably, some of the chicks have their tongues inadvertently burned during beak-trimming or they may suffer other facial injuries, which lead to certain death. All beak-trimmed birds suffer a setback in growth and development as they recover from the trauma. The accompanying beak tenderness adds to the problem by making it difficult for them to eat. When birds are moved to the layer house each bird is given a check to see if her upper beak has grown back or if it was not cut enough originally".

Roberts (1986) reports that beak-trimming is "a discredited mutilation and farmers who still practice it should be brought into line by law. It is a last ditch measure to avoid the consequences of bad management. If stocking densities are too high, the diet not balanced, or if lighting is at fault, stress-aggression occurs. To overcome it the beak is burned off cutting through a bed of highly sensitive nerve tissue, similar to the quick of the human finger nail. Another form of aggression is the competitive aggression. Birds brought together in any system will have a go at each other in order to establish the peck order. On free range or in straw yard systems the more timid hens retreat and dominance is established without bloodshed. But in a battery cage system the timid hen cannot take flight nor show submission and the confrontation often becomes a blood business leading to cannibalism and death".

1.3.2 Beak-trimming welfare research

The beak is essential to the bird for feed particle prehension, exploration of the environment, preening and social defence. It is an efficient tool. The beak epiderm contains dermal papillae, which plays an important role in precise tactile discrimination. The prevention of cannibalism is seen as a positive contribution to animal welfare as the pain and suffering resulting from cannibalism, may be much greater resulting in the death of the bird. Many producers believe that on balance the practice of beak-trimming is to be favoured, provided that the operation is performed properly (Hunton, 1990).

Using cannibalism and mortality as criteria, beak-trimming could be interpreted as having a stress alleviating effect, but when other criteria are used beak-trimming has a stressful effect on the bird (Lee and Craig, 1991). Objections to the use of beak-trimming include its removal of sensory receptors, with a subsequent reduction in feed intake (Glatz and Lunam, 1994), pecking efficiency (Gentle, *et al*. 1982), pecking preferences (Hausberger, 1992a, 1992b) drinking ability (Heidweiller, 1992), permanent loss of temperature and touch responses (Gentle, 1986b) and behavioural evidence (hyperalgesia and guarding behaviour) for persistent pain (Duncan, *et al*. 1989; Gentle, *et al*. 1990). van Liere (1995) considers that severe beak-trimming (two-thirds of beak at 650^0C) produces a long-term passivity in hens which has long lasting consequences. In birds, which have short blunted beaks, dry mash tends to block their nostrils, and in cages they are unable to clean up their food trough.

1.3.2.1 Acute pain

Gentle (1992) reports that it is generally considered that beak-trimming results in acute pain to the birds which passes quickly with the birds behaving normally a few minutes after the amputation. The results from the research of Glatz (1987) and Gentle, *et al.* (1991) suggests that the acute pain from beak-trimming is indeed short lived and some of the birds may not be in pain for 24 h after the amputation.

1.3.2.2 Chronic pain

Following this pain free period the birds may experience chronic pain for long periods of time. Only a proportion of human patients experience chronic long-term pain following amputation (Wall, 1981). It seems likely therefore that not all birds subjected to partial beak amputations will suffer phantom and stump pain, but for those, which do suffer, it will be a welfare problem. In a survey of human amputees suffering chronic pain (Sherman, *et al.* 1980) a total of 68 different methods of pain treatment were described, none of which were 100% successful. Traumatic-neuromas in the beak stump after trimming have been implicated as a cause of chronic pain in commercial hens (Breward and Gentle, 1985; Gentle, 1986a).

1.3.2.3 Neuromas

If birds are beak-trimmed earlier than 10 days old both neuroma formation and pain is reduced (Megret, *et al*. 1996). The tip of the incisive bone including the zone of ossification is normally removed with trimming. Ossification of the bone continues after beak-trimming but the order of ossification is disturbed (Kawai, *et al*. 1990). Traumatic-neuromas consist of swollen tangled masses of regenerating axon sprouts. These may form as either large masses or may develop as small scattered multiple fascicles of axons to form microneuromas (Devor and Rappaport, 1990). After several weeks, the nerve fibres regrow, the excess axon sprouts degenerate and the neuroma regresses. Occasionally, the neuroma mass persists and can discharge spontaneous action potentials that are perceived as chronic pain. Studies by Lunam, *et al*. (1996) showed neuromas were present in all beaks at 10 weeks, but neuromas were not found at 70 weeks after moderate trimming at hatch. As neuromas were not observed in adult hens that had been moderately trimmed at hatch, the results indicate that they develop and

persist for at least 10 weeks, before resolving. This would explain why other workers observed neuromas in beak stumps between 15 days and 10 weeks after trimming one-third of the upper beak (Breward and Gentle, 1985; Gentle, 1986a) at birds at 5 weeks-of-age. The presence of neuromas is not in itself evidence of chronic pain as neural activity may cease following resolving of neuromas and normal feeding and pecking behaviour could be restored.

Recent research with 6 and 21-day-old turkeys and in 1 and 10-day-old chickens suggest that neuromas do not develop after beak-trimming (Blokhuis and Wiepkema, 1998). Lunam and Glatz (1996) report, however, that neuromas will form irrespective of age of beak-trimming but neuromas have a greater potential to resolve if chicks are trimmed conservatively early in life. Gentle, *et al.* (1997) agreed and reported that trimming in 1 and 10-day-old chickens resulted in rapid healing and no scar tissue was seen, but unlike the controls the regrown tips contained no afferent nerves or sensory corpuscle which contrast with the findings of Lunam and Glatz (1996). Glatz, *et al.* (1998) have shown that birds beak-trimmed at day-old and re-trimmed at 12 weeks do not exhibit feeding and pecking behaviours in the long term that indicate they are suffering severe chronic pain. There was some evidence that beak-trimmed birds used less force when pecking and might be more sensitive to pain when drinking hot water. Mench (1992), Gentle (1996), Hughes and Gentle (1995) have reviewed all the effects of beak-trimming on welfare of poultry.

It is now the currently accepted in the scientific community that beak-trimming correctly at day-old (relative to trimming at other ages) allows birds to return to apparently normal feeding and pecking behaviours with evidence of some beak sensitivity as neuromas resolve.

1.4 History of beak-trimming

1.4.1 Comments on terminology

The word debeaking has been an inappropriate term to describe the practice as the process does not remove the whole beak as the term debeaking implies. The public quite wrongly believes that all caged hens have their beaks removed. A recent edition of a high school biology textbook published in Australia states that all caged hens have their beaks removed. More recently scientists have used the term partial amputation instead of beak-trimming. This is despite the fact that in many birds the beak does re-grow and receptors are functional in the regenerated beak tissue (Glatz, *et al.* 1998).

1.4.2 Gas Torch

Beak burning was the first method used by poultry farmers in California in the 1940's to control cannibalism in laying flocks. A gas torch was used by T. E. Wolfe in the San Diego county in California to burn off part of the upper beak of the hen and was very effective in controlling pecking vices especially feather pulling (Sundaresen and Jayaprasad, 1979).

1.4.3 Soldering Iron

Later a neighbour of Wolfe, W.K. Hopper adapted a tinner's soldering iron by giving it a chisel edge, which enabled the operator to apply downward pressure on the upper beak to sear and cauterise the beak. The Lyon Electric Company took up some of these modifications, to develop the first beak-trimming machine.

1.4.4 Heated Knife

The Lyon Electric Company first brought out a heated knife attachment for a homemade beak support and frame. The name for the machine "debeaker" was coined in 1942 and was registered in 1943.

1.4.5 Beak-trimming machines

1.4.5.1 Hot blade

Gas beak-trimming

This machine consists of a hot plate and cutting bar operated by means of a foot lever. The efficiency of the machine varies with gas pressure and wind conditions. Generally it is slow to use and it is a useful portable machine for beak trimming small numbers of birds (Pickett, 1969). Producers can currently purchase a pocket style machine for trimming pullets which uses gas from a cigarette lighter as its heat source.

Electric Soldering Iron

Wilfred, *et al.* (1982) reported on a simple inexpensive device used for beak-trimming birds consisting of an ordinary electric soldering iron commonly used by the radio mechanic for soldering. A disk or coin made of brass or copper was welded to the tip of the soldering iron and the projecting edge of the circumference of the disc was sharpened like that of a blade. When the soldering iron was connected to the wall plug the temperature of the sharpened disc at the tip attains the maximum temperature (lead melting point 327^0C) within a few minutes which is quite sufficient for cauterising the beak.

Hot blade machines

Following the development of the "debeaker" in 1943 there have been refinements to the machine including some control of cutting and cauterisation and control of blade temperature. However control of blade temperature is still assessed mostly by the colour of the blade, although thermocouples are available for measuring blade temperature. The most commonly used is the dark (dull) red heat with an approximate temperature of 650-750°C. Cherry red colour (850-950°C) is used for toe clipping.

The Lyon Electric Company in San Diego, California has been manufacturing hot blade beak-trimming machines for beak-trimming layers, broilers and turkeys for over 50 years. The Lyon Company (1982) suggest that precision beak-trimming of 6-10 day-old chicks is one of the most accurate methods available, using either the Super V precision beak-trimmer or the Dual Debeaker. The machines have a timed cauterisation of 2 sec and Lyon suggests that properly done, this method of beak-trimming will suffice for the productive life of the bird. Both models of the debeaker are available in water-cooled and water less models. Lyon also market a Super TT Debeaker which has been designed primarily for beak-trimming birds from 3-6 weeks-of-age, but can be used to trim beaks of birds up to 12 weeks-of-age, but less beak is removed at this age proportionally. With the TT method the bird is held sideways at a 90^0 angle to the blade. Both beaks are trimmed and cauterised simultaneously with an inward slant. Older bird beak-trimming is performed with the super V debeaker but blades used for cutting are heavier. Lyon recommend that when birds are beak-trimmed up to 12 weeks-of-age generally speaking two-thirds of the upper beak is removed but no closer than $1/8^{th}$ of an inch to the nostril. If the lower beak is trimmed it should protrude beyond the upper beak by $1/8^{th}$ of an inch. Beak-trimming birds over 12 weeks is generally accomplished by removing the two-thirds to ¾ of the upper beak again determined by the birds age and maintaining a distance of $1/8^{th}$ of an inch from the nostril. This severity of beak trimming is far greater than is allowed under the Code of Practice in Australia.

1.4.5.2 Cold blade

Temporary trimming

Peckham (1984) and Gleaves (1999) report using a temporary form of beak-trimming using a sharp jackknife. A nick is made in the beak about ¼ of an inch from the tip, with the thumb holding the cut portion of the beak against the blade. The knife is rolled around the tip of the beak tearing off the horny portion and exposing the quick. If properly done there is little bleeding. It is not recommended to cut into the quick without cauterisation.

Cutting with secateurs

Grigor, *et al.* (1995) used a pair of secateurs at 1, 6 or 21 days, to trim the upper beak of turkeys. There was bleeding from the upper mandible, which ceased shortly after the operation. Despite the beak growing back a reduction of cannibalism was noted. Gleaves (1999) recommends the use of a dog nail clipper for trimming beaks to protect against the early cannibalism. Gentle, *et al.* (1997) used secateurs to remove one third of the upper beak in Isa Brown chickens. There were very few differences observed between behaviour and production of the hot blade and cold blade trimmed chickens.

1.4.5.3 Robotic beak-trimming

Bock and Samberg (1990) reported information on the "Robot AG 4500" made by Gourlandt Industries Inc., Zoo-Techniquews, France which permits simultaneous, automated beak-trimming, Marek's (sub cutaneous injection) and Newcastle-Bronchitis (eye drop) vaccination of day-old chicks. This equipment has the ability to treat up to 4,500 chickens per hour. While the AG 4500 is suitable for vaccination some problems emerged with the beak-trimming. The chicks were loaded onto the robot by hand being held by cups around their heads. If the chickens were not loaded correctly they could drop off the line, receive excessive beak-trimming or very light trimming because they were not positioned correctly on the holding cups. In addition it was observed that the machine could not beak-trim chickens effectively if there was a variation in the weight or size of chickens. This information was reported in a Beyond 2000 TV program featuring the AG 4500. The robot beak trimmer was used in Australia for a short period but was not successful.

1.4.5.4 Chemical beak-trimming

Lunam and Glatz (1995) reported on the use of capsaicin applied at the time of conventional hot blade beak-trimming to retard beak growth. Capsaicin is a cheap non-toxic substance extracted from hot peppers. Applied topically or orally to mammals it induces a short term burning sensation. In contrast to this effect in mammals, capsaicin is reported to induce only mild behavioural responses when applied topically to birds (Mason and Maruniak, 1983). Indeed, some bird species demonstrate a preference for food containing capsaicin. However, capsaicin does cause depletion of certain neuropeptides from sensory nerves in birds and thus may cause desensitisation as it does in mammals. Although it's long term effect in birds is not known capsaicin can cause degeneration of sensory nerves in mammals. It is well known that if the nerve supply is removed or prevented from reinnervating a particular tissue, then the tissue will degenerate. Lunam and Glatz (1995) showed that capsaicin decreases the rate of beak regrowth, and hence the need for re-trimming by its action on the sensory nerves, but operators must avoid contact with the substance during its application to the beak. The feeding ability of birds improved with capsaicin administration in the feed and therefore has the potential to reduce the percentage of starve-outs (Glatz, 1990).

1.4.5.5 Laser beak-trimming

Van Rooijen and van der Haar (1997) reported on a laser method, which cuts the beaks of day-old chickens with a laser beam. No details were provided by the authors on the type of laser used, or the severity of beak-trimming. By 16 weeks the beaks of laser trimmed birds looked similar to untrimmed beaks. Unfortunately, feather pecking and cannibalism during the laying period were highest among the laser-trimmed hens. These results suggest that the severity of beak trimming by laser was insufficient, enabling regrowth of the beaks.

It might be expected that the use of laser beak-trimming, would enable greater uniformity in beak-trimming and improved welfare because the beak would not require cauterisation. Laser beak-trimming may represent a welfare advance but further work is required with this technology before it can be applied in industry.

After discussion with neurosurgeons and skin laser specialists at Royal Adelaide Hospital and Memorial Hospital Adelaide it was recommended that laser trimming in chicks be trialed in South Australia (SA). A SA company is manufacturing lasers for $40,000/unit compared to imported lasers costing $100,000. The locally produced laser is transportable and it is envisaged that a number of machines could be strategically located around Australia for use in beak-trimming in Australia. Mr Tony Moore (laser surgeon) from The Memorial Hospital, SA has suggested a pilot laser trimming trial could be conducted in his rooms using an ablasive laser (Urbian Laser) which has a high affinity for water. This laser should be able to cut through the bony portion of the beak. Alternatively another form of ablasive laser (Scitom), which operates with stack pulses may be suitable for sealing the highly vascular beaks. Alternatively a coagulative laser (Nd.Mag) could be trialed.

1.4.5.6 Bio beak-trimming

The most innovative of more recent developments in the last 10-15 years has been the Bio Beaker, which uses a high voltage electrical current to burn a small hole in the upper beak of chickens. In the 1980's the Bio-Beaker (Sterwin Laboratories, Millsboro, Delaware, USA) was developed which used a high voltage arc (1500 Volt AC electric current) across two electrodes to burn a small hole in the upper beak of chickens. Up to 2000-day-old chicks can be beak-trimmed in an hour using this process. The chicks being bio-beaked struggle as the beak is inserted into the mask of the instrument and also when the current is passed. Grigor*, et al.* (1995) reports that it takes 0.25 seconds to burn a hole in the beak. The primary advantage of the Bio-Beaker is that an adequate beak-trim is achieved during the first day of life, making the unit ideal for use in the hatchery. This allows treated chickens to eat and drink normally for the first few days with their beaks intact. It was originally hoped that after a period of 3-7 days, the portion of the forward of the hole (tip of the beak) would die and slough off leaving a rounded stump. The aim was to burn a hole in the upper beak at a point just beyond the horny projection. In about 4 days the chick should begin to lose that portion of the upper beak from the hole to the tip and by 10-14 days-of-age, this portion of the beak should be completely lost from all the chickens.

Unfortunately in many chicks the tip of the beak did not slough off and birds had to be re-trimmed using conventional equipment. In turkeys, however, the bio beaker was more successful (Grigor, *et al.* 1995) with the beak tip falling off in 5-7 days and the wound healed by 3 weeks (Noble and Kestor, 1997). This method is used for trimming the upper beak of turkeys by Aldinga Table Turkey Company in South Australia, but operator errors and inconsistencies have caused welfare problems for the turkeys. In this respect Renner, *et al.* (1989) found that severe arc beak-trimming 1 mm from the nostril in turkeys increased

mortality relative to hot blade trimming. In contrast Noble, *et al.* (1994) compared arc trimming and intact beak males and found no difference in mortality of male turkeys.

Not unrelated to the bio-beak process was the method developed for broiler chickens by Smith (1997) who used the hot blade to burn an area near the tip of the upper beak. The procedure allowed a thin base to exist to the tip of the beak. The chick could eat and eventually the upper beak dropped off. This method was examined by Brian Verrall, Andersons Hatchery, Halbury, South Australia in the 1960's but it was not effective.

1.4.5.7 Freeze drying method

O'Malley (1999) used liquid nitrogen to declaw emus but found the conventional hot blade method was more effective. The freeze dry method was costly, time consuming and regrowth of the claws occurred. Development of equipment that could freeze and cut the beaks, however, may be worth investigating.

1.5 The best age to beak-trim

1.5.1 Overview on beak-trimming

Unless the beak-trimming process is done very carefully and accurately, the effects from it are frequently worse than the problem it is supposed to save (Wells, 1983). Decision about beak-trimming includes the age to trim, amount of beak to remove, temperature of the blade and length of time to cauterise the beak. These factors coupled with differences in beak growth characteristics have the potential to create an endless number of combinations many of which are harmful to the individual bird (Ridlen, 1981). Beak-trimming will set a flock back by 2-3 weeks through a reduction in feed consumption and body weight. Feeders should be kept filled, adequate drinking water provided and procedures, which might stress the bird, should be minimised. Extra care is required to ensure birds using nipple drinkers are able to consume sufficient water after beak trimming.

The beak-trimming method should be tailored to strain. One method may work with one strain but maybe quite inadequate for another aggressive strain. Many producers are able to beak-trim their flocks at seven days with the precision method. However this method sometimes fails to hold the flock for its entire life.

Chickens can be beak-trimmed in the hatchery before delivery, at 5 to 9 days (precision or block beak-trimming) or at 6, 10 to 12 weeks, during the growing period. Many hatcheries are reluctant to carry out beak-trimming prior to delivery. Hatchery operations point to the combination of stresses to which baby chicks are exposed – sexing, vaccination, and transportation, to which they say beak-trimming seems a further addition. This is despite the knowledge that day-old trimming results in fewer birds needing to be re-trimmed (Andrade and Carson, 1975), that age of trimming does not influence mortality (Carson, 1975 and Lee, 1980) and performance is enhanced by earlier trimming (Glatz, 1990). Glatz and Lunam (1994) have shown that there is no heart rate response to trimming in the newly hatched chicken. However, the heart response immediately after the stress is imposed, increases by 14 beats/min at 10 days-of-age to 34 beats/min at 42 days-of-age. This result suggests that if beak-trimming has to be performed it should be done at hatch. One of the problems however, is that many hatcheries dealing only in pullet chicks do not have the skilled operators to perform long-lasting beak-trimming (Hunton, 1982).

There is also an art in the husbandry of caring for day-old beak-trimmed chickens. Nevertheless, where experience shows that hatcheries are competent and capable of doing a good job of day-old beak-trimming, this is an attractive proposition because it avoids an extra handling, and the associated stress during the growing period. Personnel must be well trained and experienced if this method is to be successful.

Probably the most popular time for beak-trimming in the USA is over 7-10 days-of-age (Table 1) as the chick has grown and operators feel it is easier to perform the precision required. This situation also applies in Australia, although 9-10 days of age is more popular. At the earlier age (7-10 days), birds are often much easier to catch and to handle than 6 week-old chickens and the overall operation can be conducted with much less stress on both birds and beak-trimming personnel. Beak-trimmed birds need access to open water troughs.

Table 1. Summary of USA 1990 beak-trimming schedules

Age	Percentage	Cost (US c/pullet)
1 day	6	1
6-10 days	25	1.5-2
2 weeks	1	2
4 weeks	1	2.5
6-7 weeks	17	2.5-3
10-12 weeks	35	3.5-5
* 7-8 weeks	2	5-7
*10-12 weeks	13	5-7

* preceded by beak-trimming at 6-10 days-of-age
(from International Poultry Practice, June 1990 edition)

At 10-12 weeks, beak-trimming is more costly to perform (Table 1) and imposes greater stress on the birds although all birds should be checked at this age to decide if re-trimming is required. Whenever beak-trimming is contemplated, the timing should be such that it does not coincide with other stresses. New crews of beak-trimmers should be carefully trained and supervised by experienced personnel and birds beak-trimmed by them followed carefully to ensure that the desired technique is in fact being performed.

1.5.2 Day-old beak-trimming

Wells (1983) reports that beak-trimming at the hatchery before delivery of the chicks may be convenient and relatively cheap, but recommends against this approach, because of higher mortality and the likelihood of beaks growing out. Many hatcheries are reluctant to carry out beak-trimming prior to delivery (Hunton, 1982) although it is a common practice to beak-trim at day-old in the U.K. (Gentle, 1988). On the other hand dual beak-trimming and vaccination of day-old chickens has been commonly performed using a commercially available device (Beak-O-Vac, Inc., Box 715, Gainesville, Georgia, 3051) which simultaneously beak-trims and emits a fine spray of vaccine into the trachea (Eidson, *et al.* 1975)

Sundaresan (1979) compared performance of chickens trimmed at day-old, 2 weeks, 4 weeks to an untrimmed control group. There was no significant difference among the treatment groups in body weight gains, although there was a consistent trend for improved weight gains in birds trimmed at day-old and at 2 weeks. Feed efficiency was significantly better among the beak-trimmed groups, but no difference in mortality was observed between the treatments.

Birds beak-trimmed at day-old have a permanent reduction in body weight (Andrade and Carson, 1975 and Glatz, 1990), and eat less food without affecting egg weight and production. However, Wells (1982) in his editorial, reports that that he would not recommend beak-trimming at day-old because the birds are already under enough stress from sexing, vaccination and transportation. He recommends beak-trimming between 5-10 days or 10-12 weeks as the best time for performing a permanent job which can last throughout the laying period. On the other hand recent welfare research has shown conclusively that the best age to beak trim chickens is at day-old or soon after hatch. Field trials are needed to convince the Industry one way or the other that beak trimming at day-old is effective.

1.5.3 Early Precision Beak-trimming (5-10 days)

E.L. Bramhall developed trimming at 5-10 days in the early 1960's at the University of California. Bramhall and Little (1967) compared early precision beak-trimming at 10 days-of-age with late precision beak-trimming at 12 weeks and observed that early beak-trimming resulted in a 4.2 % improvement in egg production. Johnson (1978) suggests that 7-9 days is the best age to trim as the beak is more horny and if the beak-trimming job is done correctly there is no reason why any birds should be re-trimmed. In contrast Ridlen (1981) reports that the precision method at 5-10 days sometimes fails to hold the flock for its entire life, while Smith (1982) suggests that the precision method is best performed at 6-10 days, with a follow up trim at 10-14 weeks. The moderate method is performed at 10-14 weeks involving removal of one-third of the lower beak and two-thirds of the upper beak. The severe method is also done at 10-14 weeks. It involves removing two-thirds of both the upper and lower beak and is often performed in USA as a follow up to the earlier precision trim method.

High quality beak-trimming at 7-10 days probably has a minimum effect on weight gain, in contrast with the effects of beak-trimming at 10 to 12 weeks. To beak-trim a 5-10 day-old and a day-old chicken it is held with the thumb on the back of its head and forefinger under the throat. Alternatively, Verrall (personal communication) recommends that the thumb should be wrapped around the upper body of the chicken during beak trimming, while Johnson (1978) suggests that the thumb be placed on one side of the head, with the forefinger curved around the neck on the other side. This prevents operators pushing too hard on top of the head causing internal bleeding in the brain with no outward signs of why the bird died. The closed beak is inserted into the $11/64^{th}$-inch hole in the gauge plate of precision trimmers or operators judge the correct amount of beak to remove. Light pressure is exerted on the throat to pull back the tongue and prevent it from being cut or burnt. This also withdraws the lower beak slightly so that is a little longer than the upper beak when beak-trimming is completed. Care should be taken not to sever or burn the tongue. Treadle type beak-trimmers are used as well as power units with a motor controlled cam that pushes the hot blade through the beak, automatically timing the operation. The blade remains in the cutting position for 2^{+} seconds during which time cauterisation of the remaining tissue is accomplished (Andrade and Carson, 1975). If it is done correctly it eliminates the need for a second beak-trimming (Sundaresan and Jayaprasdad, 1979). The blade of the beak-trimmer should be heated to a cherry red colour and should be sharp and straight edge. Overheating the blade will cause it to warp under pressure and cause blisters in the mouth. A cold or blunt blade will fracture the beak and cause sensitive bulb like growths on the cut end. There is an Industry view in Australia that beak-trimming birds at 5-10 days is the best age to trim because of reduced mortality and beak regrowth compared to day-old trimming. Verrall (personal communication) recommends holding the blade just above the cutting bar with an adjustable set screw which assists the operator to line up the blade with the beak.

1.5.4 Beak-trimming at 4-6 weeks

At Cornell University, Charles Ostrander, poultry extension specialist preferred to beak-trim chickens at 4-5 weeks. This is the time when birds are transferred from brooder cages to rearing cages. He stated the beak-trimming at 4-6 weeks will last throughout the laying year. However Renganathan, *et al.* (1982) observed that performance of pullets was superior if they were beak-trimmed at 2 weeks compared to 6 and 12 weeks. With older pullets the birds mouth is opened with the index finger of the right hand holding the tongue down and back to prevent it from being burnt or severed. The upper beak is rested on the cutting bar so that it rests evenly and a cut is made by slowly moving the hot blade down on the beak by means of a foot pedal. Sufficient pressure is exerted to cut the beak slowly, cauterising it at the same time. The lower beak is then cut in the same fashion. Care should be taken to cauterise the beaks thoroughly by rubbing up against the hot blade momentarily after cutting, and also to round off the corners. Some producers beak-trim their flocks at 4 weeks-of-age if the pullets are being grown on nipple-type drinkers. The idea behind this is to minimise any weight loss.

1.5.5 Beak-trimming at 6-8 weeks

One advantage of beak-trimming at 6-8 weeks is that pullets have more time to regain lost body weight compared to those beak-trimmed closer to maturity. An editorial in International Hatchery Practice (October, 1988) suggested that if the crew is experienced beak-trimming at this age generally results in more accurate results compared with beak-trimming at an early age. In light controlled housing it is recommended to beak-trim at 7-8 weeks (Hooge and Thomas, 1984; Schonewille, 1985; Euribrid, 1985). Hooge and Thomas (1984) found that beak-trimming at 7 weeks versus 1, 3 or 10 weeks improved feed conversion. The double inside slant method at 6-8 weeks is practiced using a Lyons Model TT electric debeaker involving the use of a V type blade that allows the upper and lower beaks each to be cut with an inside slant in one operation after being inserted into the guide holes (Andrade and Carson, 1975).

1.5.6 Beak-trimming at 8-16 weeks

Carey (1989) compared 9, 12 and 15-week beak-trimming and demonstrated significantly lower adult feed consumption, mortality rate and hen-day egg production in the birds trimmed at 9 weeks. Late non-precision beak-trimming is usually performed with the Lyons Electric Super Debeaker with a heavy-duty cutting blade. Andrade and Carson (1975) removed two-thirds of the upper beak and one-third of the lower beak in 12 week-old birds followed by a brief un-timed cauterisation. Amount of beak removed was determined by visual inspection.

1.6 Severity of beak-trimming

Hargreaves and Champion (1965) reported that beak-trimming one half or three quarters of the beak did not result in any loss of egg production, but reduced food consumption and body weight gain. In severely trimmed birds there were changes in the consistency of the outer covering of the regrown portion of the beak. In Australia it is generally accepted that removal of half the upper beak and one-third of the lower beak at the tip of bone at 5-10 days results in reduced mortality compared to more moderate levels of beak-trimming (personal communication with supervisors of Random Sample Tests conducted in Australia during the 1970's).

Shirley and Srinivasan (1972) investigated the effects of removing ¼, ½, and two-thirds of the upper and lower beak. All the birds with ¼ of the beak removed showed considerable regrowth, 50% of the birds with ½ of the beak removed showed regrowth whereas those birds with two-thirds of the beak removed showed virtually no regrowth. As the temperature of the blade was

increased from cold, medium to hot the proportion of birds showing regrowth decreased emphasising the point that cauterisation is required with a hot blade to reduce regrowth. Beane, *et al.* (1967) also found that resulting beak regrowth was dependent on cauterisation time and amount of beak removed. The authors recommend that ½ to two-thirds is the amount of beak to remove with a cauterisation time of 1 second. Kuo, *et al.* (1991) found that birds, which had ¼ of the beak, removed at 4 weeks using the V cut, regrew, whereas those that had ½ the beak removed continued to be shorter than the control group. Strong (1990) recommends that beaks be trimmed leaving 2 mm beyond the nostril at 6-10 days, and to avoid re-trimming, leave 1 mm beyond the nostril. For birds 10-12 weeks-of-age, beaks should be trimmed 6-7 mm beyond the nostril with 2 sec of cauterisation. Conventional moderate and severe beak-trimming at 12 weeks were compared to precision trimming at 7 days. There was a definite advantage in hen housed production, feed efficiency and mortality when using severe trimming (Ridlen, 1981).

Many problems associated with poor performance in the laying house can be traced back to the differences in beak length. Strong and Reynell (1984) found that the production of severely trimmed birds and those with bubble growths (from being over cauterised) were inferior to properly trimmed birds. Adequate feed depth must be maintained in flocks with long lower beaks. Water must also be maintained at a level that will enable chickens with long lower beaks to drink without difficulty. During periods of high water consumption it is urgent to increase the water flow in trough systems so that all birds can drink regardless of their location on the water line.

1.7 Blade temperature

Hunton (1982) reports that the blade should be heated to 1500 ^{0}F at which point it will appear a dark cherry red colour. If an automatic device is being used, the cam should be set so as to give a cauterisation time of 2.5 seconds or less.

Maizama and Adams (1994) found that chickens precision beak-trimmed at 10 days with a blade temperature of 1450^{0}F consumed 1.5 g more feed per chick day to 18 weeks than chicks beak-trimmed with blade temperature of 1200^{0}F. There was no effect of blade temperature on production, efficiency and mortality during lay. Strain differences were noted in mortality and feed efficiency for beak-trimming when blade temperature was 1450^{0}F compared to 1200^{0}F. Precision beak-trimming at 7 or 10 days using 1000^{0}F or 1200^{0}F had no effect during the rearing or laying period. Johnson (1978) suggests that blades should have a dark cherry red colour for beak-trimming. Use of high temperature causes bubbles and protrusions or “proud” flesh to develop on the end of the beak. Older birds need a higher blade temperature. In contrast Gleaves (1999) says that an excessively hot blade causes blisters in the mouth whereas a cold or dull blade causes a fleshy bubble like growth to develop on the end of the mandible. Blade temperature is commonly evaluated by looking at the blade colour (Table 2), which can vary with the light conditions in the area where beak-trimming is being performed. A bright room will cause the blade to look duller while a dark room will make the blade look hotter. Standard light conditions or a device to measure blade temperature is critical, if beak trimming is to be consistent. The use of a small light that illuminates the blade while the rest of the shed is at normal lighting is an effective practical method for standardising lighting.

1.8 Cauterising time

Cauterising of a wound to stop bleeding is as old as the medical profession. With birds there is the additional advantage of cauterisation to promote healing and prevent the possible spread

of disease especially coli and staphylococcus. Beak-trimming crews use various temperatures (Table 2) and cauterising times. Some operators use lower blade temperature and longer cauterising times and others use a hotter blade with shorter cauterising times (Table 3). The use of a rolling motion to cauterise the beak is recommended as a means of inhibiting regrowth and to prevent the formation of sharp edges on the outer edges of the beak.

Table 2. Blade temperature and colour, and cauterising time for trimming at 6-10 days

Colour	Temperature		Cauterising Time (seconds)
	^{0}C	^{0}F	
Light Red	500-550	932-1022	3
Dull Red	650-750	1202-1382	1* or 2.5**
Bright Red	850-950	1562-1742	0.75-1.0* or 2.0**
Yellowish Red	1050-1150	1922-2102	Not used

*Non permanent; end of beak is only singed and is red in colour,** Permanent (required to stop further growth of beak tissue)
(from International Poultry Practice, June 1990 edition)

Table 3. Blade temperatures and cauterising times as related to age of bird

Age at beak-trimming	Cauterising time *	
	At 696^{0}C (1300^{0}F)	At 864^{0}C (1600^{0}F)
1 day	2.5	2.0
6-10 days permanent	2.5	1.5
6-10 days, non permanent	1.0	0.75
7-8 weeks	1.0	0.5**
10-12 weeks	1.0	0.5**

* In seconds
** Two cuts, time per cut
(from International Poultry Practice, June 1990 edition)

1.9 Angle of the cut

The angle of the cut should be given close attention. Generally a straight cut is made at 0-10 days-of-age although it is possible to get an angled cut at 10 days by holding the head slightly lower than horizontal and cut both beaks at one time (block trimming). Slanting the cut of the upper beak is more possible after 6 weeks-of-age, but more difficult to do on the lower beak. The angled cut of about 5-10^0 is more important to achieve when the birds are retrimmed. If the cut is made at an improper angle the beak can become deformed or impacted and the bird rendered worthless (Shirley, 1977). An increased incidence of impacted beaks results from the inability of the bird to control the flow of salivary secretions and the resultant increased wetness of the feed leads to impaction of the beak. This abnormality interferes with eating and drinking, reducing feed efficiency.

1.10 The need for hot blade beak re-trimming

A Californian survey of beak-trimming practices by Bell (1984) on replacement pullet farms, found that re-trimming was practiced at 10-15 weeks in 85 % of the flocks. The remaining 15 % of the farms were able to successfully prevent picking with one trimming at 10 days-of-

age. In Australia there is anecdotal evidence that re-trimming may not be required in many birds, but to avoid the potential problem of cannibalism as a result of beak re-growth most birds are retrimmed at 10-14 weeks. Bell (1992) lightly trimmed 3 strains at 10 days-of-age followed later with a permanent trimming at either 6 or 12 weeks-of-age. The optimum re-trimming age was strain-related. The early re-trimming improved income in 3 of the strains. Andrade and Carson (1975) reported that 80 % of the birds that were precision trimmed at 1 and 6 days-of-age did not require re-trimming, whereas 88 % of birds first trimmed at 12 and 16 weeks did not need re-trimming at 20 weeks. Birds trimmed at 6 weeks with a double slant all needed to be re-trimmed, whereas 50 % of those precision-trimmed at 8 weeks needed to be re-trimmed. Bakker (1999) reports that proper precision beak-trimming permits only a maximum of 1 % error and only one trim is needed for whole life of the chicken.

Birds should be re-trimmed lightly again between 12-17 weeks-of-age, although most producers have experienced carry-over effects into the egg production period. Re-trimming at the later ages can cause a delay in sexual maturity. If birds are beak-trimmed properly at an early age further re-trimming is not necessary. Re-trimming of older birds is more difficult to manage. One method is to hold the bird with the thighs under the operator's arm, keeping the wings close to the operators forearm and body to prevent flapping. The operator places the index finger of the free hand between the ends to keep the beak open and enable the top beak to be severed. At the same time the finger holds down the tongue to prevent accidental burning (Nowland, 1969).

Carey (1989) re-trimmed birds at 9, 12 and 15 weeks using the Lyon Electric Company Model TT debeaker® as described in Lyon Electric Company Bulletin #135 (Lyon Electric Company, 1982). Age at 50% production was achieved later among birds trimmed at 9 weeks than among those trimmed at 12 or 15 weeks. Feed consumption, egg production, and mortality was lower among those trimmed at 63 days.

Technical Department of International Hatchery Practice recommends beak-trimming at 6-10 days, then touch up at 7-8 weeks or 10-12 weeks. Such an early schedule helps to avoid early pecking. It also allows more permanent beak-trimming to be completed well before the flock comes into production.

Hot weather, open housing, high bird density and large colony sizes generally necessitate more extreme beak-trimming and re-trimming, but these effects can be reduced with less aggressive strains. Carey and Lassiter (1995) report that in order for beak-trimming to be performed only once, the savings in labor and other costs associated with the second beak-trim must be greater than the costs associated with the increased feed intake. Beak-trimming twice significantly reduces feed intake. Age of beak-trimming the bird according to Carey and Lassiter (1995) is not a factor in any long-term performance statistic.

1.11 Best practice beak-trimming procedures

1.11.1 Equipment

Trimming chickens throughout the day requires that the beak-trimming machine be properly installed on a table or metal frame so that the machine is stable during the operation. The machine should be centred on the right shoulder line of right hand operators and vice versa for left handed people (Bakker, 1999). The blade normally used for beak-trimming is the Lyon BC blade. The blade has 2 sharp edges on each side and normally after 5,000 chicks it is recommended to turn the blade when it becomes blunt. Each blade can last for 10,000

chickens. A new blade should be installed or new sharp edges should be put on the old ones if the used blade is not bent or deformed. Deformed blades should be thrown away. The blade is mounted so that the sharp edge is always positioned towards the chicken.. If the blade is mounted improperly the beaks will be mutilated and the beak-trimming will be very irregular. New blades are very resistant and hard, but with high temperatures (yellow-red) will lose the hardness and can deform the blade. A thermocouple should be used to measure the blade for correct operating temperature.

1.11.2 Seating

Use of straight-back chair enables the operator to sit up close to do the work with back support to minimise fatigue. Seating should be avoided where legs are either up in the air or slouched down (Johnson, 1978). Electrical cords should be retractable on reels. Maximum concentration must be maintained by staff to ensure a proper job. About 600-900 chicks can be trimmed per hour.

1.11.3 Catching chicks and beak-trimming chickens (from Johnson, 1978)

- Use large plastic buckets to hold chickens (day-old-10 days-of-age).
- Catch chicks by driving over to one side of the pen and retaining them with a low fence running the lengthwise of the pen.
- Position beak-trimming equipment outside pen.
- Operator can reach over low fence to pick up buckets of chicks or crate of chicks.
- With a bucket of chickens between the knees the operator uses his right hand to hold the chicken that is being beak-trimmed.
- As soon as chicken has been beak-trimmed, the operator's hand moves to one side and chick is released dropping down onto the litter outside the enclosure.
- To cushion the fall of the chicks, the litter is mounded up slightly where they drop or use folded up bags.

1.11.4 Minimising stress of beak-trimming (from Bolla, 1977)

- Catch birds quietly whilst still contained within the brooding surrounds.
- Do not leave chickens in confined surrounds for too long as they will overheat and tend to bleed more readily when beak-trimmed.
- Wire mesh surrounds or catching frames are recommended, as they do not restrict the ventilation. Wire mesh should be covered with hessian to prevent stacking and pile-ups of birds. Vented plastic holding baskets are preferred to solid wooden or cardboard containers.
- As an alternative to dropping chickens onto mounded litter, operators can use a wooden or sheet metal slide to place chickens into after beak-trimming to prevent chickens flying or falling onto equipment.
- The beak should be inserted at an angle of about 30^0 up from the horizontal plane into either the $11/64^{th}$ inch hole or $5/16^{th}$ inch hole in the gauge plate of precision trimmer.
- Blade should be heated to a dull red colour.
- Automatic timing keeps the cutting cauterising blade in position for 2^+ seconds, and the chick's beak should be held there for the entire time.
- An average rate of about 15 birds/minute should be maintained. A lower rate is more desirable because there is less chance of errors occurring from rushing the process.
- Beak-trimming will be consistent and uniform if done by a specialist with a good reputation.
- Beak-trimming both upper and lower beaks so as to form a V shape wedge is the usual type of cut preferred.
- The second or final beak-trim is desirable in pullets that are not more than 12-14 weeks-of-age.

1.11.5 Staff Skills *(from Leeuwin, 1981)*

- Beak-trimming staff require skill and dexterity (Wells, 1982) and should only be carried out by trained and experienced staff, familiar with the preferred technique and given clear instructions. Inexperienced people may cause a problem worse than the one they are trying to contain. All new personnel should be closely supervised.
- The air quality of the environment for beak trim operators is poor with high smoke and dust levels. Staff should take adequate precautions to maximise occupational health and safety.
- Skilled operators know how to maintain their equipment properly.
- The operator should be seated comfortably and in such a fashion that each beak can be cut properly or in the same manner.
- Common faults are burnt tongues, top beak too short and raw, bottom beak too long or too short.
- The mandible should not be pulled way from the blade until it is completely severed. Incomplete severance causes torn tissue in the roof of the mouth.
- Not all birds have the same length or width of beak and so removing the same amount of absolute beak means that the proportion of beak removed will vary.
- Poor trimming will result in birds not being able to eat properly either because they cannot pick up the feed or eating is painful. Such birds die from starvation or produce poorly. Poor beak-trimming will cause food wastage because the bird cannot pick up feed properly.
- Many problems in the laying house can be traced back to differences in beak length. Improperly beak-trimmed pullets cannot reach their optimum potential in the laying house.
- A shallow feed depth can impair egg production when the hens have long lower beaks rather than short lower beaks.

1.11.6 Care of birds before and after beak-trimming *(Petersons Farms, 1999)*

- Administering vitamin K through drinking water 2-3 days prior to trimming can be considered as an option.
- Mechanical feeders should be operated frequently to stimulate feed consumption. If cart fed, birds should receive feed at least twice daily.
- Birds should not be subjected to stress from housing, vaccination or worming during the week prior to or the week after trimming.
- Give no medicines which will give a bad taste to the feed or water, or which dilute the blood like sulphas.

1.11.7 Blade Cleaning

When using the precision method once a day or more often the plate should be taken off to scrape away the dried blood and tissue to enable a proper cut. The plate should be adjusted such that the blade is snug against the plate. If there is a space between the blade and the plate a poor cut will result. If the blade is too snug against the plate, odd shaped beaks will result from trimming. To make sure that the blade and plate are against one another the unit can be triggered to bring the blade edge down to the half-way point on the plate. Push the plate against the blade to make a snug fit and then tighten. The blade should be sharp and scraped every 15 minutes to remove the fine grey residue, which accumulates from the birds during beak trimming. The Lyon K blade should be used for open trimming and the BC blade for hole trimming.

1.11.8 Use of Analgesics

The beak is a complex organ containing many sensory receptors. Immediately after trimming birds will suffer acute pain. Studies by Glatz, *et al.* (1990) indicate that analgesics have the

potential to overcome the initial pain following trimming and their use should be encouraged for chickens subject to beak-trimming. A mixture of bupivicaine (local anaesthetic) and phenylbutazone (anti-inflammatory) can be swabbed onto beaks immediately after beak-trimming, or beaks dipped into ice-cold water.

1.11.9 Common Errors in beak-trimming *(from Singh, et al. 1981)*

- The upper and lower beaks are cut too short.
- Lack of cauterisation.
- Nostrils of the chicks are burnt.
- The beaks are cut on the side, leading to crooked beaks on account of rushing and holding too many chicks in one hand while trimming birds using the other hand.
- The beaks are cut at the wrong angle.

1.11.10 When to delay beak-trimming *(Strong, 1990 and Schonewille, 1985)*

- When the flock is sick.
- Never beak-trim in combination with vaccinations except for fowl pox, when moving birds or when birds are on blood diluters, blood thinners.
- Schonewille (1985) suggests not to beak-trim at temperatures above 27^0C although this can be impractical under Australian conditions.

1.12 Alternatives to beak-trimming

1.12.1 Implanting hormones

Hughes (1973) implanted gonadal hormones in pullets aged 12 weeks and development of feather pecking was monitored. Up to 18 weeks progesterone produced a moderate increase in pecking, oestrogen and progesterone together a much greater increase. From 18-24 weeks (the normal onset of lay) the rise in pecking was prevented by testosterone. The hormonal balance is important in determining the expression and extent of feather pecking. Egg production was reduced by the hormonal treatment.

1.12.2 Blind chickens

The first reported case of hereditary blindness from an autosomal recessive gene in chicken appeared in the literature from the work of Hutt (1935) with a further report from Cheng, *et al.* (1980). The mutant gene (Cheng *et al*, 1978) was designated rc to indicate the absence of rods and cones in the retina. Genetically blind chickens remain fully feathered, produce more eggs and eat less feed, and is superior to all other methods of controlling feather pecking (Ali and Wahed, 1985).

1.12.3 Spectacles (restricting vision of birds)

The use of spectacles (anti-pecking devices made of a coloured flexible polyethylene material), when fitted on the nares of the hens allows birds to look to the side or down but not directly ahead (Cummings and Epps, 1976). The use of spectacles was effective in controlling feather pecking (Arbi, *et al.* 1983). Pecking damage was higher for control hens compared to hens with spectacles, which were better feathered after 11 months of lay. The use of spectacles has the advantage in reducing social stress by limiting visual contact and breaking down the social hierarchy. Mechanical devices also have disadvantages since they can only be put on birds of pullet size or larger, they are relatively expensive and they take considerable time to fit to the bird. They cannot be used in cages because they interfere with eating and drinking, can be easily dislodged and these devices are held in place by metal clips which pierce the nasal septum (Robinson, 1979).

1.12.4 Contact Lenses

Red contact lenses were first used in the 1960's for layers as an alternative to beak-trimming. They failed to gain popularity because they caused considerable eye irritation, eye infections, abnormal behaviour, and they were not retained well. The lenses were redesigned recently in attempt to eliminate or reduce these problems. The maker of the lenses (Animalens, Inc.) report that lenses have a calming effect on the birds, eliminate the need for beak-trimming, eliminate cannibalism, reduce feed usage and increase egg production. Birds can be fitted with the lenses at the rate of approximately 10 birds/minute. Adams (1992) studied the effects of red plastic lenses on egg production, feed per dozen eggs and mortality after being inserted at 12 or 16 weeks-of-age. Egg production was lower and mortality higher, attributed to the inability of birds to find the feed. More recently coloured contact lenses for laying hens have been introduced. Hens fitted with red lenses (rosy glasses) appeared to be the least stressed.

1.12.5 Environmental enrichment devices

Environmental enrichment reduces aggressive behaviour and mortality and improves feather condition and egg production (Church, 1992; Gvaryahu, *et al.* 1994 and Yasutomi and Adachi, 1987). Sherwin (1993) found that hens rapidly habituate to simple objects hung in their cage. Studies have been undertaken on commercial farms using environmental enrichment devices. The devices failed to show significant effects within experiments but when all the data was combined a significant improvement in economic returns from using the devices was observed (Bell, personal communication). Preliminary studies undertaken at Roseworthy using enrichment devices introduced to layers at 30 weeks-of-age in cages failed to divert pecking away from birds (Glatz and Rodda, unpublished). Enrichment devices may need to be introduced to chickens at a very early age for them to be effective.

1.12.6 Bitting devices

More recently, plastic anti-pecking devices have been developed for use in game birds (Faure, *et al.* 1993; Kjaer, 1997) which are held in place by lugs inserted in the nares. Studies by Savory and Hetherington (1997) concluded these devices are not commercially applicable to laying hens. In pheasants rings are fitted in the nostril and between mandibles to prevent complete closure of the mandibles. A bumper device protrudes beyond the beak tip to prevent complete closure of the mandibles. The use of bits as a preventative measure against feather pecking is not permitted in many countries (Kjaer, 1997).

1.12.7 Tin Pants

Gleaves (1999) reports on the use of 'tin pants' on the vent to minimise vent pecking.

1.12.8 Changing the light intensity

The intensity of light can be manipulated in poultry houses to reduce social interactions among the flock mates. Hughes and Black (1974) observed that bright light (55.8 lux) compared to dim light (17-22 lux) increased activity in birds. They found a direct relationship between activity and pecking damage. Abraham and Glatz (2000) report that hens exhibit an increase in aggressive and stereotype behaviour when exposed to higher light intensity. Head flicking, vent, tail, head and body pecking were the behaviours most closely associated with light intensity. Therefore under low intensity light it is possible that the birds cannot see each other well, this reducing antagonistic encounters and aggressive behaviour among them. It is

important to eliminate areas where bright sunlight strikes the floor. The use of very low light during the first 3 weeks of rearing may discourage any pecking vices developing in poultry avoiding the need for beak-trimming.

1.12.9 Rearing under red light

For many years it was practice to brood and rear chickens under red light to prevent cannibalism (Fairfull and Gowe, 1987) but there is little direct evidence that this practice is effective. Low intensity white light is satisfactory.

1.12.10 Provision of straw, grain and whey blocks

A number of authors have suggested that feather pecking and subsequently cannibalism in poultry may be considered as redirected ground pecking, based on strong similarities in the performance of both behaviours. Blokhuis and Wiepkema (1998) report the main strategy to prevent feather pecking is to provide an adequate substrate. Substrate conditions during the rearing period affect the development of feather pecking. Use of scratch grain is recommended. During the rearing period Gleaves (1999) recommends the location of semi sold milk or whey blocks around the house, hanging green leafy vegetables and spreading grass clippings to prevent feather pecking.

1.12.11 Use of anti-pick compounds

Applying anti-pick compounds (commercial anti-pick, pine tar or axle grease to wounded areas reduces pecking (Gleaves, 1999). Studies by Bishop (unpublished) in Western Australia have also shown that commercially available sprays can be applied to wounds and bare areas on the body to improve feather cover.

1.12.12 Genetic strategies

Craig and Lee (1990) reported large differences in feather pecking and mortality in three strains tested and indicated potential for identifying stocks that may require less severe beak-trimming than is commonly practiced or no trimming at all. Kuo, *et al.* (1991) observed that cannibalistic deaths occurred less frequently in stock selected on family performance without beak-trimming hens, compared to unselected stock. In addition Craig (1992) suggests that at least one stock of White Leghorns does not require beak-trimming and later suggests that stocks can benefit from selection against beak-inflicted injuries (Craig and Muir, 1993; 1996). Duncan and Hughes (1973) report that selection procedures in the past may have made the matters worse by discarding pecked birds and leaving the birds, which were doing the damage.

Primary breeders need to select strains with a low tendency to pick. Breeders have been reluctant to do this in the past because they would have to relax selection pressure on production traits and thus put themselves at a commercial disadvantage to their competitors. Muir and Craig (1998) by selecting separately for rate of lay and longevity using a kin selection method, have developed a strain of laying hen that shows much less feather pecking and cannibalism than a control strain and with no decrease in productivity. The experimental strain enjoys a higher level of welfare in cages because it does not require beak-trimming. The addition of a behavioural trait in a commercial breeding program is generally resisted by breeding companies although there is potential for changing the propensity for feather pecking and cannibalism if the underlying low fearfulness of a strain can be selected (Hocking, 1994).

Current gene mapping efforts will provide information at the molecular level of gene function and could provide alternative strategies for improving welfare than by conventional selection. Biotechnology has the potential for suggesting novel methods for improving welfare such as the manipulation of a receptor for a neuro transmitter involved in the control of pecking behaviour. The existence of genetic markers for welfare traits will permit markers assisted selection to take place, possibly obviating the need to measure complex behavioural traits in commercial selection programs.

1.13 Implications of not beak-trimming

It is possible to rear pullets without beak-trimming if there is effective light control (Wells, 1983). However once an outbreak has occurred it is difficult to control cannibalism (Allen and Perry, 1975). Rearers should leave beaks intact only if they are satisfied that there is little if any risk involved. The more flighty aggressive strains need to be reared at lower light intensities than others are. Control of pecking is quite different and more problematical in the laying stage when a higher light intensity up to 5 lux needs to be provided. Under some conditions it might be possible to manage laying hens without beak-trimming, but for most producers, the risk of such a policy is too high.

Bell (1998) reports on an experiment by Anderson and Davis (1997) who found that 6 day and 11 week beak-trimmed birds produced at a significantly higher rate, better feed conversion, reduced extra large eggs, reduced fearfulness and improved feather cover compared to untrimmed controls. Bell (1996) compared trimmed and untrimmed flocks and found that non-trimmed birds laid at a 2% higher rate, produced 4.2 more eggs per hen housed, produced heavier eggs and greater egg mass, were heavier, but consumed more food. Economic analyses revealed that beak-trimmed flock had a 24c/bird hen housed advantage. Glatz (1990) also found that layers that were not trimmed consumed significantly more food but in contrast to results of Bell (1996) laid fewer eggs, had poorer food efficiency and higher mortality (25% v 8%) than beak-trimmed hens. Over the period 20-40 weeks-of-age Maizama and Adams (1994) also observed that mortality of untrimmed birds was high (6.3 % v 1.2 %) compared to trimmed birds. Bell (1996) reports that care must be taken when considering the 'no trim" form of management. He states "elimination of beak-trimming may seem to be an attractive goal but it must be done with caution and careful consideration of all the consequences".

Hens, which had 10, 20, 30, 40 and 50 % of the upper and lower beak-trimmed at 10 days-of-age using the non-precision method were reared under low light conditions and no cannibalism was observed. During the laying period birds were housed in cages in a naturally ventilated shed. At 32 weeks-of-age the experiment was terminated because of severe outbreaks of cannibalism in the lightly trimmed groups as a result of the regrowth of beaks (Glatz, unpublished data).

1.14 Alternative production systems and beak-trimming

It is not possible to ban beak-trimming due to the risk of damage caused by pecking activity especially in alternative systems or in open sided houses where light intensity is high. Feather pecking and cannibalism amongst birds kept in virtually all of the alternative systems remains unpredictable and a major problem yet to be solved (Petersen, 1994; Blokhuis and Wiepkems, 1998; Tauson and Abrahamsson, 1992; Blokhuis and Metz, 1996; Kathle and Kolstad, 1996; Elson, 1990; Engstrom and Schaller, 1993 and Norgaard-Nielsen, *et al*., 1993). Increased pecking and cannibalism is considered to be caused by the larger group sizes. Losses of up to

13% of a flock of laying hens have been reported in an aviary (Hill, 1886) and of up to 15% in both a strawyard (Gibson, *et al.* 1988) and a free range system (Keeling, *et al.* 1988). Gibson, *et al.* (1985) found persistent high mortality in a covered strawyard system despite being temporarily abated by beak-trimming at 28 weeks-of-age.

Michie and Wilson (1985) did not beak-trim birds prior to housing in perchery but it was found necessary to beak-trim five of the six pens because of cannibalism. The policy was that all birds in a pen were beak-trimmed after two birds had been pecked. In a second trial however no cannibalism was observed. Cannibalism seems to be much worse in some aviary systems than in the same strain of birds kept in cages although the problem is not consistent. Under these circumstances Norgaard-Nielsen, *et al*. (1993) suggests that it may be essential to beak-trim laying hens in alternative systems on welfare grounds. On the other hand Appleby and Hughes (1991) report that where flocks in alternative systems have been compared directly with cages and no cannibalism problems occurred mortality was similar. However when cannibalism did occur it was disturbingly high in an aviary (14.6 %) and a strawyard (13.3%). The presence of males has been an important factor in reducing this behaviour problem in females.

Appleby, *et al.* (1988) found that mortality was quite low in a deep litter system for 2 years but in the third year birds which had not been beak-trimmed suffered from cannibalism. In a comparison of deep litter with cages, outbreaks of cannibalism occurred in both systems in flocks that had not been beak-trimmed, but not in flocks trimmed at one day of age. In welfare terms current alternative systems housing large flocks of laying hens have a chance of an outbreak of cannibalism providing a major argument against the system. No strategy guarantees that feather pecking will not develop in practical poultry keeping and beak-trimming may be required in specific cases to prevent the greater risk of welfare problems caused by cannibalism.

CHAPTER II

INDUSTRY EXPERIENCE WITH BEAK-TRIMMING

(The author of this review has over 30 years experience with beak trimming. Chapter II contains the personal views of the author on beak trimming and also includes opinions from experienced contract beak trimmers).

2.1 Beak shape

- If both the lower and upper beak are equal in length and retain the same shape as the original beak (despite being trimmed) then birds will continue to be effective at feather pecking and engaging in cannibalism
- There should be a distinctive gap of at least 2 –3 mm between the lower and upper beak to minimise the effectiveness of feather pecking
- The beaks should be squared off with an inward slant at their tips similar to blunt pliers to reduce the effectiveness of pecking

2. 2 Beak length

- If birds are feather peckers and there is a high incidence of cannibalism the beaks of birds should be as short as possible to limit the effectiveness of pecking.
- It is generally considered that European strains have a higher incidence of pecking and these birds should be more severely trimmed. European strains have been selected under low light conditions and aggressive birds may not have been eliminated in the breeding program. On the other hand, Australian strains have been selected under higher light intensity and the more aggressive birds not used for breeding.
- Beaks, which are not trimmed and cauterised at least to the tip of the bone in the beak, regrow and need to be re-trimmed.

2.3 Beak hardness

- Birds with harder beaks are easier to trim and generally, the beak-trimming process is more effective with fewer birds needing to be re-trimmed.
- The beak stumps of birds with harder beaks recover better after beak-trimming and there is a reduced incidence of bleeding following beak-trimming, reduced incidence of beak abnormalities (proud flesh) and beaks appear to have no areas showing inflammation.
- Birds with softer beaks are more difficult to trim, have an increased incidence of bleeding, will regrow after trimming if not trimmed back to the tip of the bone and appear to develop more beak abnormalities.
- Birds with softer beaks need to be routinely re-trimmed, as it is difficult for beak-trimmers to achieve the aim of removing sufficient beak with the correct cauterisation to limit regrowth while at the same time not causing permanent damage to the beak.

2.4 Beak-trimming process

- Beak-trimmers prefer to use the non precision method of beak-trimming using visual assessment to trim the amount of upper and lower beak which in their opinion will limit the effectiveness of feather pecking
- Use of the precision method using the holes of set size is not routinely used. Beak length varies and amount of beak removed when placed in the standard hole sizes of the beak-trimming guide plate will result in a variable amount of beak being removed. Beak-trimmers believe it is easier to judge the amount of beak to remove for each bird.
- If the beak-trimming plate with or without set hole sizes is not water cooled during the beak-trimming process birds will suffer burns on the top and bottom portion of the beak just back from where the cut has been made.
- It is difficult to judge where the tip of the bone is in each beak at trimming to ensure that regrowth does not occur after trimming.
- When the beak-trimming set up is correct, a clean straight cut will be achieved with a characteristic click as the blade cuts the beak and cauterisation is performed. The cauterised section will have a light brown colour on the outer edge of the cut and darker brown colour in the centre of the beak where the blood vessels and bone have been cauterised. There will be evidence of bleeding if the beak has not been cauterised sufficiently or if blade is too hot.

2.5 Bleeders

- There are a small percentage of birds in each strain, which will bleed following beak-trimming despite best beak-trimming practice being used.
- There is a characteristic sizzle during the beak-trimming process as blood pours from the wound against the blade.
- It is recommended to apply an extra 1-second cauterisation to seal the wound.

2.6 Is beak-trimming required?

- Many farmers express the view that beak-trimming should be utilised to reduce feed wastage.
- Alternatively some farmers request that birds not be beak-trimmed.
- There is a recent view being expressed that beak-trimming is not required for birds provided natural light in floor based systems. Some people also contend that birds in cages under natural light also do not need to be trimmed. This view is often expressed when people with limited experience have not observed any cannibalism in a few flocks.
- Industry experience over the years from stock persons caring both for pullets and layers indicates that it is possible to get away without beak-trimming with some flocks. Most experienced poultry stock persons however have witnessed dramatic outbreaks in cannibalism when they least expected it to occur. Cannibalism is highly unpredictable, unpleasant and a very costly problem which causes extreme hardship to the birds.
- A stockperson may have inspected an apparently normal flock earlier but on their return to check the flock an hour later have observed outbreaks of cannibalism which had no apparent cause. This experience usually has resulted in stock persons insisting that beak-trimming be practised routinely on all flocks to avoid these sudden and quite dramatic outbreaks which have lead to high bird mortality.

BEAK-TRIMMING

CHAPTER III
Ten Year Strategic Plan

2000-2010

3.1 Vision and Mission

The Australian Egg Industry is committed to ensuring that there is a continual improvement in the quality of beak-trimming to minimise mortality of layers from cannibalism in all production systems.

Vision

'Uniform and consistent beak-trimming performed by well trained closely supervised crews to minimise pain, beak regrowth and pecking vices in poultry'.

Mission

'To ensure R&D leads to reduction in pecking vices in poultry by establishing state of the art beak-trimming technology utilised by well trained closely supervised beak-trimming crews.'

3.2 Beak-trimming-Industry Background and Outlook

Light Intensity
Most consumers consider that the mutilation of all livestock is undesirable and continue to regard beak-trimming as a major welfare insult. Egg Industry people recognise that where light intensity cannot be controlled beak-trimming is necessary and helps to avoid worse problems.

Injurious Pecking
The avoidance of injurious pecking is a major difficulty and research workers and the poultry industry are continuing to address the problems of feather pecking and cannibalism to find satisfactory solutions. The causes do not appear to be fully understood and it is difficult to determine why a flock in which such pecking does not occur may be followed by one, kept in the same conditions, in which injurious pecking may be prevalent. In Australia at least there does not seem to be a workable solution to the problem of feather pecking and cannibalism without the need for beak-trimming. There is evidence of differences between strains of hens in relation to a wide range of behaviour patterns. Indeed, different strains of hen demonstrate different levels of injurious behaviour.

Strain Differences
This is an area for research which should particularly consider the relationship between strain of bird, colony size, stocking density, house environment and need for beak-trimming. It is understood that selection for traits, which have an effect on welfare, such as injurious pecking behaviour, is currently at an early stage but there is reason to believe that this approach may result in improved welfare. There is potential for genetic selection to overcome, either partly or wholly, the problem of feather pecking and cannibalism and hence the need for beak-trimming. Almost all the strains used in Australia now are from imported genetics and so the selection work done is minimal.

Quality of beak-trimming
Over recent years in Australia there has been a decline in the standards of beak-trimming as old experienced staff retire from the Industry. There is an urgent need to establish an Industry Accredited-training course for all beak-trimming staff. In Australia birds are being beak-trimmed with varying degrees of severity although code recommends not more than half of the upper and one third lower beak may be removed. Re-trimming of older birds is common in the Industry and could be avoided if research was undertaken to establish whether early beak-trimming at the point of bone ossification (quick) in each beak will avoid the need to re-trim.

Best Practice Beak-trimming
Recent evidence in Australia and from Europe indicates that beak-trimming at hatch or soon after results in little long term pain and research suggests that beak-trimming at this age will reduce injurious feather pecking and cannibalism in later life. There is a need for more work on beak-trimming of birds at a young age to determine optimal age for each strain and best technique (hot blade or laser technology) and the long term effects of this treatment in relation to injurious feather pecking and cannibalism.

Training
The House of Commons Agriculture Committee (1981) proposed beak-trimming operators should act under veterinary supervision. A survey conducted by Ministry of Agriculture Fisheries and Food (1984) showed that the amount of beak removed was variable. In some

flocks the average upper beak removed was 22% whereas some birds lost half the beak and other suffered no damage. Similar findings were seen in the lower beak. There is a need to licence beak trim operators or supervisors and aim for more consistent beak-trimming.

3.3 THE TEN YEAR R & D PLAN

2000-2010

The following pages set out R&D areas and strategies designed to address the key beak-trimming issues.

Overall Objective:

To initiate and support outcome-oriented R&D which leads to consistent and effective beak-trimming of all strains of birds in all production systems.

3.3.1 Objective One: Consistent and effective beak-trimming

- To promote beak-trimming practices which account for strain differences, light intensity, cage density and production system.
- To encourage beak-trimming protocols which take into account individual bird variation.
- Utilise beak-trimming techniques, which minimise regrowth of the beak.

Strategies

➔Establish if there is a difference in pecking behaviour of strains under various light intensities, cage density and type of production system. Determine if pecking characteristics of birds need to be monitored as new strains are made available to Industry.

➔Establish if there are anatomical differences between birds, which have hard and soft beaks, and whether different methodology is required when beak-trimming.

➔Determine the differences in vascular properties of beaks in birds, which bleed after beak-trimming relative to non-bleeders. Investigate the use of drugs, which could be administered prior to beak-trimming to avoid bleeding of beaks after trimming.

➔Determine the differences in zone of bone ossification in beaks and whether these influence the level of beak-trimming required in birds and the subsequent pain response.

➔Clarify immediate and chronic pain associated with beak-trimming of young chicks. Assess the longer-term effects of various methods of beak-trimming on pecking behaviour patterns and whether beaks that re-grow are used for injurious feather pecking and cannibalism in a similar way to un-trimmed beaks.

Targets

- New protocols for beak-trimming established.
- Reduction in the level of cannibalism.

Performance indicators

- Improved bird welfare and production.
- Reduction in complaints concerning beak-trimming.

3.3.2 Objective Two: Establish an Accreditation System for Beak-trimming

- To promote the importance of an accreditation system for improving beak-trimming standards.
- To prepare appropriate documentation to standardise beak-trim training in Australia.
- To satisfactorily resolve the most urgent welfare issues of achieving consistent beak-trimming.
- To improve public perception of beak-trimming.
- To continuously improve the standards of beak-trimming.

Strategies

➔ Conduct a workshop run by a facilitator experienced with Rural Training and invite field representatives from pullet suppliers, producers, RSPCA, beak-trim operators, geneticists and beak-trim researchers to develop an outline of the training documentation

➔Where appropriate, allocate R&D funding to develop the training documentation to ensure a link with national training competencies

➔Conduct a national communication program to ensure all Industry is aware of training program.

➔Conduct a course to licence beak-trim operators with refresher course every three years.

➔To strive for world's best practice standards of beak-trimming.

Targets

- Training package implemented.
- Panel of beak-trim operators trained and licensed.

Performance indicators

- Decrease in level of community concern on beak-trimming.
- Improved bird performance and welfare.

3.3.3 Objective Three: Improvement of information transfer

- To effectively communicate and disseminate the results of beak-trimming research and development, and facilitate information and technology transfer.

Strategies

➔To publish annually progress on beak-trimming projects and outcomes of final reports.

➔Assist in the dissemination of research results, where appropriate, through fact sheets, seminars and workshops on best practice beak-trimming and the effects of beak-trimming on production and welfare.

➔To promote awareness of the influence of diet, health, environment and all other factors on feather pecking and cannibalism.

➔Develop best practice manuals and videos for all sectors of the industry to raise quality standards.

➔Develop an Internet site on beak-trimming to assist in the exchange of information.

Targets

- Appropriate extension materials available on beak-trimming.
- Effective mechanisms for rapid information and technology transfer of beak-trimming technology.

Performance indicators

- Speed of uptake of technology and ideas.
- Improved knowledge base of beak-trimming.

3.3.4 Objective Four: Establish High Technology Beak-trimming Methods

- To investigate laser technology as a new method of beak-trimming.
- To investigate cold cutting beak-trimming technology using liquid nitrogen.
- To establish methods to ensure the beak is cut and sealed at tip of bone in the upper and lower beaks.

Strategies

➔Determine the most effective laser method for beak-trimming birds.
➔Examine the most effective cold cutting techniques for beak-trimming birds.
➔Examine methods for development of equipment to detect the bone tip in the upper and lower beak to ensure cut and cauterisation is made at this point.
➔Compare welfare and performance of bird's beak-trimmed with laser, hot blade, cold and freeze cutting methods.

Targets

- Laser technology established.
- Cold cutting technology established.

Performance indicators

- Improved bird welfare
- Decrease in level of community concern on beak-trimming

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Communications Strategy

The findings from this study will be communicated to Industry as follows:

- Report of key findings and recommendations will published in Winter 2000 issue of in "In an Egg Shell". This newsletter is mailed to all sectors of the commercial Egg Industry in Australia.

- There will be a seminar presentation of the review to South Australian egg producers at SA Pig and Poultry Fair in October 2000

It is also proposed to present the main findings of the review at the following conferences:

- 2001 Poultry Science Symposium in Sydney
- 2001 Australasian Stockfeed Convention in Queensland

Findings will also be communicated in:

- Refereed scientific journals
- Poultry magazines
- Fact sheets for egg industry
- Presentations at regional egg producer meetings