Draft Scientific Report to the EFSA Panel on Animal Health and Welfare (AHAW)[1,]

Practice of harvesting feathers from live geese for down production[2]

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BACKGROUND AS PROVIDED BY THE EUROPEAN COMMISSION

The practice of plucking feathers from live geese is prohibited in the EU as it does not comply with the provisions of Article 3 of Council Directive 98/58/EC which requires that "Member States shall make provision to ensure that the owners or keepers take all reasonable steps to ensure the welfare of animals under their care and to ensure that those animals are not caused any unnecessary pain, suffering or injury".

The Community is a contracting party of the European Convention for the Protection of Animals kept for Farming Purposes of the Council of Europe. Both the Convention and its applicable provisions which are specified in several Recommendations are part of Community law. The Recommendation on geese adopted in 1999 provides in paragraph 3 of Article 23 that "feathers, including down, shall not be plucked from live birds".

However, the Standing Committee of the European Convention distinguishes between plucking feathers from live birds, which is forbidden, and harvesting feathers which is allowed. Harvesting down feathers from live geese consists of removing feathers that are ripe due to the natural phenomenon of moulting.
Following a request from the Commission, two Member States declared that the practice of harvesting feathers from live geese was carried out in their countries.
The Community must give effect to the principles laid down in the Convention and if necessary make further provisions for the uniform application of the Convention and its Recommendations.

TERMS OF REFERENCE AS PROVIDED BY THE EUROPEAN COMMISSION

The Commission requests EFSA to assess the welfare of geese from which feathers are harvested for down production during their lifetime.
It is preferable to carry out the assessment in two steps.
As a first step of the mandate, the following data from scientific studies and from stakeholders should be collected and assessed:

- Data on the physiology of moulting in geese;
- Data on the conditions under which the practice of harvesting feathers from live geese is carried out;
- Data on the welfare aspects of keeping geese for down and meat production;
- Data on the differences in quality between feathers collected from live geese and feathers collected after the slaughter of geese in slaughterhouses;
- Data on the quantity of feathers harvested from live animals and the quantity of feathers collected after the slaughter of geese.

The collection of data should cover the Member States of the European Union and also, if possible, the Third Countries involved in the trade of goose feathers.

As a second step and taking into account the data collection carried out, the opinion should evaluate the following points:

- Whether it is possible to make a clear distinction between the plucking and harvesting of feathers from live geese and which criteria could be used to differentiate these two practices;
- Whether harvesting feathers from live geese can be carried without causing unnecessary pain, suffering or injury to the birds;
- The impact of the practice of harvesting down feathers has on the overall welfare of the geese.
- Whether there is a difference in quality between feathers collected from live geese and feathers collected in slaughterhouses after their death.
- Which animal-based indicators could be used to assess the welfare of geese submitted to this practise.

Finally, if the opinion concludes that harvesting down feathers from live geese can be carried out under certain conditions without causing unnecessary pain, suffering or injury to the birds, recommendations should be made on the conditions to be respected during the harvesting and on how the potential negative impacts of this practice could be minimised throughout the raising of the geese. Additionally, animal-based indicators to assess the welfare of the geese submitted to this practice should be defined.

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LIST OF TABLES AND FIGURES - GLOSSARY

GLOSSARY

Gathering feathers
Removing feathers that are ripe due to the natural phenomena of moulting (HUN: tollszedés; DE: lebendraufen).

Mature feathers
Feathers of full size and form.

Plucking of feathers
refers to the forcible removal of feathers still attached to the body (i.e. not ripe). (HUN: tolltépés; DE: rupfen).

Ripe feathers
Mature feathers ready for shedding and can be removed with minimal force and no tissue damage.

ASSESSMENT

1. Introduction

As a first step of the request from the Commission to EFSA to assess the welfare of geese from which feathers are harvested for down production during their lifetime, data from scientific studies should be collected and assessed. This Scientific Report presents the collection of data in relation to the practice of harvesting feathers on live geese. The first part presents the scientific information about the differentiation between plucking and harvesting, the physiology of moulting in geese and about the welfare aspects of keeping geese for down and meat production including the needs of geese and the assessment of pain and stress during feather harvesting. The second part shows the conditions under which the practice of harvesting feathers from live geese is carried out, starting by an overview of goose husbandry and the effect of domestication and selection of geese on feather production. Finally the scenario of geese production in commercial practice and the harvesting practices are detailed.

2. Scientific information

2.1. Distinction between plucking and harvesting/gathering of feathers

The Standing Committee of the European Convention makes a distinction between the plucking of feathers from live birds, which is forbidden, and the harvesting of feathers which is allowed. The actual wording in paragraph 3 of article 23 is that 'feathers, including down shall not be plucked from live birds' (Council of Europe, 1999). Some people object to the term 'harvesting' since it gives an inappropriate image of the process, preferring instead 'gathering' or 'collecting' feathers and down. For the remainder of this scientific opinion the word 'gathering' will be used instead of the word 'harvesting'. Gathering feathers from live geese is defined as removing feathers that are ripe due to the natural phenomena of moulting. By ripe feathers we mean feathers ready for shedding, which can be removed from the bird with minimal force and with no tissue damage (see Figure 1). Feathers that were not ripe and removed at other stages of development are shown in Appendix 2. In some of these pictures tissue and blood can be seen at the base of the feather (e.g. Figure 13). In contrast, the word 'plucking' refers to the forcible removal of feathers still attached to the body (i.e. not ripe).

For ease of communication, the European Down and Feather Association (EDFA) in their statement on the harvesting of feathers and down (EDFA statement) prefers to use the phrase 'live plucking according to the rules' when they speak of harvesting feathers and down from the live animals at the moment of moulting. They condemn improper live-plucking. Thus the phrase 'live plucking according to the rules' is equivalent to 'gathering of feathers and down from the live animal'. It should be noted that the distinction between whether or not the bird is alive is important, since the plucking of feathers following slaughter is allowed and not a welfare issue.

Figure 1. New feather (below the line) pushing out the ripe feather (above the line). Only the part of the feather above the line is removed during the feather gathering procedure (Kozak, 1999)

Experts are able to distinguish between ripe feathers and non-ripe feathers (Kozák et al., 2010). This is because, as explained above, non-ripe feathers often have some blood or tissue attached to them. This is removed during the cleaning process. Since the gathering of ripe feathers would never result in tissue damage, while improper plucking would (e.g. bleeding follicles as a result of ongoing blood supply and skin damage due to greater force required to remove feathers), this could be a way of distinguishing these activities in practical terms. Once the feathers have been processed it is more difficult to make this distinction as the only difference is in the shape of the base of the feather shaft (more pointed in non-ripe feathers). Feathers removed from dead birds are a mixture of ripe and unripe and are used for different purposes.

Depending on whether the feathers are gathered, plucked or removed from slaughtered birds, the ratio of ripe and non-ripe feathers is different. In the case of gathered feathers the proportion of non-ripe feathers is small (<2%, Menési et al., 1964) whilst in feathers from slaughtered birds the percentage of non-ripe feathers is 45% (Zielinska and Baczkowska, 1973). Presumably, the percentage of non-ripe feathers following the plucking of feathers from live birds would exceed 2%. Therefore, in practice, the increased percentage of ripe feathers would allow a distinction between gathering and plucking from live birds.

2.2. Physiology of moulting in geese

Bird feathers are keratin structures subject to wear and tear. To maintain their functionality in flight and thermoregulation feathers need to be regularly re-grown. Feather growth, but also the shedding of feathers ("moult") is under endocrine control. Because moulting is energetically costly and impairs the functionality of flight or thermoregulation, moulting should be timed appropriately to avoid impairment of crucial life history periods such as reproduction or migration. Therefore, despite some common ground, moulting patterns are usually adaptive and are highly variable between species (Stresemann and Stresemann, 1966; Welty 1982). Geese, for example, shed their primaries (wing and tail feathers) synchronously and become flightless at their annual low of gonadal steroids (Hirschenhauser et al., 1999), after hatching of their goslings. Primaries are re-grown 5 weeks later, allowing parental geese to get airborne together with their fledging offspring. The insulating secondaries (e.g. breast feathers) are shed in fall, ahead of migration.

In birds, moulting is generally based on endogenous cycles, but is modified by external Zeitgeber, such as photoperiod, temperature and condition of the animal. Autonomous dynamics in the sensitivity of the feather papilla in interaction with hormonal cycles regulate the moulting process. For example, there are consistent and close relationships between the onset of moult, peak prolactin and high thyroid hormones (T4) and glucocorticoids, but low gonadal steroids. Because gonadal regression towards photo-refractoriness coincides with low sex steroids and peak prolactin, moulting is generally post-reproductive in many birds. In particular, decreasing estrogens together with peak prolactin and high T4 trigger moulting in birds (Dawson, 2006; Wilton, 2000). It seems as if the gonadal axis (and potentially, the hypothalamo-pituitary-adrenal stress axis) provides the main factors. Experimentally elevated androgens, for example, will indeed, inhibit moulting (Dawson, 2008). However, in contrast to urodele amphibians and lizards, the role of thyroids seems to be permissive and supportive rather than causative in birds.

The general regulatory mechanisms behind moulting are probably the same in wild and domesticated birds, e.g. in greylag and swan geese and their domesticated forms. However, domestication may loosen selective pressures towards behavioural and physiological economy (Herre and Röhrs, 1973). Birds in the wild should minimize their time of impaired flight or thermoregulation, for example, whereas geese in human custody may do well even when flightless or with a less than optimal down cover. This relaxation of selection pressure may permit extra partial moult cycles, called partial because some feathers, such as primary flight feathers, are not moulted. Young geese enter their first moult at 9-10 weeks of age and may then undergo a moult cycle approximately every 6 weeks (FAO, 2002). Although, there is a general agreement that geese do shed feathers at these times, there are no

published data on hormonal changes confirming that feather gathering cycles in domestic geese are true moult cycles.

There is evidence for loss of feathers related to traumatic events, which are associated with a sharp raise in plasma corticosterone (see 2.3.3.). This may precede a fall in sex steroids, which leads to moulting (Bentley, 1998). In an extreme form, this mechanism may also cause trauma-induced "stress-moult" or "shock-moult", as well as starvation-induced moult, because starvation always comes with high initial levels of glucocorticoids.

In wild geese, during moulting (i.e. shedding and re-growing feathers), heart rates tend to be elevated and individuals are generally more stress-prone and shy than at other times (Kotrschal et al. unpublished). This may be relevant for feather gathering, as it cannot be excluded that moulting domestic geese may also be more stress-prone in response to manipulation and handling.

Keeping conditions may affect the occurrence of moult cycles. Although the basic synchronization of moulting within groups is provided by a common stimulus regime, e.g. light cycle, there is also social synchronization. In greylag geese, for example, parental geese shed their wing feathers and become flightless approximately a week after hatching of their young (Kotrschal et al., 2010). Because pairs in a flock may be a month apart in the hatching date of their young, this within-family synchrony cannot be due to the light cycle, but must be due to social synchronisation. Likely, the synchrony of the parental pair in moulting is achieved via their hormonal responses to their offspring rather than due to direct interaction between pair partners (Hirschenhauser et al., 1999).

2.3. Welfare aspects of keeping geese for down and meat production

Welfare is a characteristic of an individual animal and is concerned with the effects of all aspects of its genotype and environment on the individual (Duncan 1981, EFSA reports, e.g. Welfare of dairy cows EFSA 2009). The common convention is to use the term "welfare" to refer to the state of the animal itself, while 'animal care' and 'animal protection' are used to refer to the way that people treat animals. The degree to which the welfare of an animal is good or bad is taken into account when considering what constitutes proper animal care.

Broom (1986) defined welfare as follows: the welfare of an animal is its state as regards its attempts to cope with its environment. Coping means maintaining control of mental and bodily stability in response to a challenge. Welfare therefore includes the extent of failure to cope, which may lead to disease and injury, but also ease of coping or difficulty in coping. The costs of coping are important for an animal's welfare. For example, an animal may cope with an acute stress in the short-term by taking action that results in a long-term reduction in its welfare.

The welfare of an animal is strongly affected by the extent to which it suffers from unpleasant emotional states or feelings such as pain, fear or frustration and positive mental states, such as happiness (Broom 1991; Duncan, 1996; Fraser and Duncan, 1998; Boissy et al., 2007; Broom and Fraser 2007). Feelings are a part of many mechanisms for attempting to adapt to and cope with good and bad aspects of life and most feelings must have evolved because of their beneficial effects (Broom, 1998, 2006). Although feelings cannot be measured directly, their existence may be deduced from measures of physiology, behaviour, pathological conditions, etc.

Welfare varies from very poor to very good and can be scientifically assessed. Assessment of welfare means obtaining data that provide information about how good or poor the welfare is. Some measures of welfare concern the short-term, i.e. minutes or hours, whilst others concern welfare during periods of days, weeks or longer. Measures of welfare are described by Broom and Johnson (2000) and by Broom and Fraser (2007). There are many measures that we can use to assess the welfare of the animal and, in order to evaluate welfare fully, it is necessary to take a wide range of measures. Measures of animal health provide useful information about animal welfare. The word "health", like

"welfare", can be qualified by "good" or "poor" and varies over a range. However, health refers to the state of body systems, including those in the brain, which combat pathogens, tissue damage or physiological disorder (Broom and Kirkden, 2004; Broom, 2006b). Welfare is a broader term than health, covering all aspects of coping with the environment and taking account of a wider range of feelings and other coping mechanisms than those associated with physical or mental disorders. Disease, implying that there is some pathology, rather than just pathogen presence, always has some adverse effect on welfare (Webster, 2001; Broom and Corke, 2002) but not all welfare challenges involve poor health. The pain system and responses to pain are part of the repertoire used by animals to help them to cope with adversity during life. Pain is clearly an important cause of poor welfare (Broom, 2001a, see Section 2.3.2). However, the feeling of pain is not the only negative emotion that can influence welfare. In some circumstances, the feeling of fear may have a more important negative impact on an individual than substantial pain.

Physiological and behavioural measurements can be useful indicators of good or poor welfare. Many of the variables that have been found to lead to good or poor welfare, have been established following studies demonstrating preferences by animals (Dawkins, 1990, Kirkden et al., 2003). However, as pointed out by Duncan (1978; 1992) and Dawkins (2004), all data from preference studies must be interpreted taking account of the possibilities that, firstly, an individual may show a positive preference for something in the short-term which results in its poor welfare in the long-term, and secondly, that a preference in a simplified experimental environment needs to be related to the individual's priorities in the more complicated real world.

Welfare outcome indicators are a sub-set of welfare indicators. These are measures that can be made on-farm, or at other places of animal use, by veterinary or other inspectors as well as by the producers themselves. Many of these welfare outcome indicators are animal-based in that they involve measurement of the animals themselves.

If there is a net severity/intensity of poor welfare, or intensity of good welfare, and this is plotted against its duration, the best overall assessment of welfare is a function of intensity and duration, ideally measured as the area under the curve thus produced (Broom, 2001b).
In order to promote good welfare and avoid suffering, a wide range of needs must be fulfilled as the needs have a key role in the interaction between an animal and its environment. A need is a requirement, which is part of the basic biology of the animal, to obtain a resource, receive stimuli or express particular behaviours (Broom and Johnson 1993, see discussion by Hughes and Duncan, 1988; Toates and Jensen, 1991; Vestergaard, 1996). Needs are requirements that are necessary to maintain the biological functioning of the animal.

2.3.1. Needs of geese and welfare indicators

Geese have a set of needs that allow them to maintain themselves within tolerable limits. These needs involve brain and body mechanisms and, in some cases, are satisfied by physiological change whilst in others they are satisfied by carrying out particular behaviours and receiving specific stimuli. Knowledge of needs helps us to design better housing conditions and management methods (Fraser and Matthews, 1997). The needs to breathe air of sufficient quality, to show reproductive and parental functions and to avoid harmful chemical agents are of little relevance in relation to this report.

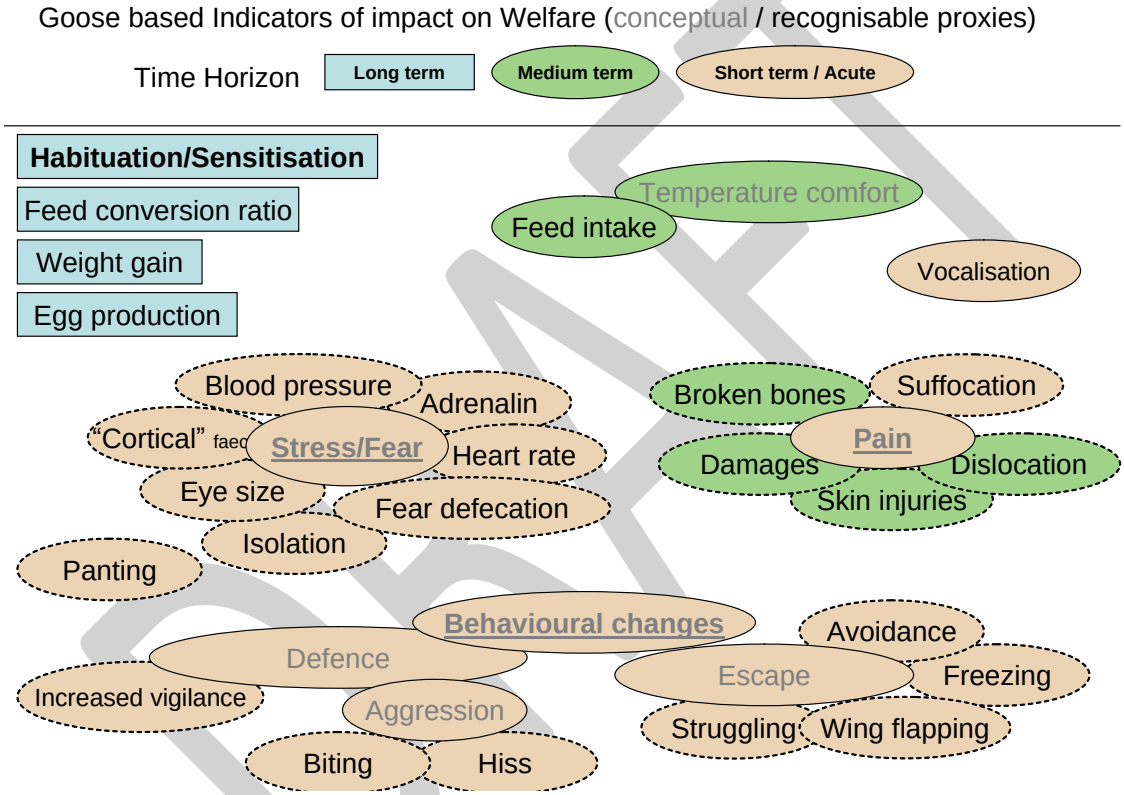
If geese are isolated in small pens or restrained, their needs to have appropriate sensory input, to exercise and to have appropriate social interactions may not be met. Indicators of poor welfare (see Figure 2) related to these needs are struggling and other escape responses and reduced activity (Sanford et al 1986).

The needs of geese to avoid fear and other negative experiences, to perform maintenance and eliminatory behaviour and to avoid pain and injury may not be met as a result of inappropriate handling and by the process of pulling out feathers (Bögre, 1981, Vier Pfoten, 2009).The consequence

may be avoidance behaviour, freezing, hissing, biting, defecation, elevated heart-rate and adrenal hormone levels, expanded eyes and weight-loss (Millan 1999).

Geese need to rest and sleep and to have an appropriate thermal environment. If they do not have these they may show panting, changed activity levels, or responses to being cold and wet. The needs to obtain adequate nutrients, to show normal foraging behaviour and to maintain water balance may not be met in changed metabolic circumstances after plucking and lead to modified food intake, weight changes and attempts to find the missing resource (Schneider, 1991). A need to avoid and minimise disease that is not met results in pathological conditions and their various clinical signs together with other specific and measurable changes in physiology and behaviour (Pálffy, 1980).

Figure 2. Geese needs in relation to welfare indicators



2.3.2. Assessment of pain during feather harvesting in geese

Pain in animals has been defined as a sensation and feeling associated with actual or potential tissue damage (Broom, 2001c). Pain is a multidimensional phenomenon which has three main components; a sensory discriminative component, an affective and motivational component, and a cognitive and evaluation component. There is no reliable and universal indicator of pain; in practice, a range of physiological and behavioural measures are used to arrive at an estimate of the probability of animal pain in a particular situation. All of the components of pain have been demonstrated in bird species leading to the conclusion that avian pain is likely to be experientially similar to mammalian pain and therefore equally ethically relevant (Gentle, 1992). Across bird species, pain has been investigated in detail almost exclusively in the domestic fowl (except for few studies in pigeons), and it is this knowledge that must be extrapolated to geese for the purposes of this report.

Pain may be divided into acute, sub-acute and chronic phases, where acute pain occurs at the moment of injury, followed by sub-acute pain, which may develop into chronic pain. Acute pain lasts from

seconds to days and usually results from nociceptive stimulation or minor trauma. It functions as a warning of damage or potential damage and is likely to invoke withdrawal from and future avoidance of the stimulus, while the sub-acute phase provokes protective behaviour that aids healing following injury (Millan, 1999). Acute pain is most relevant for the subject of concern here, as gathering feathers as distinct from plucking has been defined as removal of 'ripe' feathers that does not cause tissue damage.

Skin and feather follicle innervation

To detect acutely painful experiences the tissue involved must have the necessary sensory receptors to detect actual or potential injury. Like mammals, birds have nociceptors, specialised receptors preferentially sensitive to noxious or potentially noxious stimulation. Nociceptors are present in avian skin and have been identified in ducks (Dorward 1970), pigeons (Necker and Reiner 1980) and domestic fowl (Holloway et al 1980; Gentle et al 2001). Detailed response characteristics of skin nociceptors have been investigated in the fowl (Gentle 1989; Gentle et al 2001). The follicular wall of the feather is richly supplied with sensory fibres which are present in the papilla, pulp and feather muscles (Lucas and Stettenheim 1972). At least three types of mechanoreceptors have been shown to be associated with feathers and in the chicken high threshold pressure receptors have been found to be associated with feather follicles (Holloway et al 1980). Low threshold mechanically sensitive receptors which respond to feather movement have also been identified in both the duck and chicken (Dorward 1970, Gentle 1987). In the goose, a third type of mechanoreceptor was identified which showed vibrational sensitivity (Gottschaldt 1985). These receptors probably correspond to the Herbst corpuscles which are usually found adjacent to feather follicles (Winkelmann and Myers 1961; Ostmann et al 1963a).

Pain associated with feather removal

When moulting is not taking place feathers are firmly held in the follicles and the force required to remove them is significant. For example, removal of dorsal feathers of the White Leghorn hens using a steady pull required forces ranging from 400 to 750g (Ostmann et al 1963b). Since these forces are considerably in excess of the 2 to 5 g required to activate mechanothermal and high threshold mechanical nociceptors in the skin (Gentle, 1989; Gentle et al., 2001), it is reasonable to conclude that feather removal outside of the moult has nociceptive consequences. The forces required to remove feathers during feather gathering are not known, although if the feathers are ripe (i.e. about to fall out) there is unlikely to be pain associated with the gathering procedure. However, if the forces applied exceed the mechanical thresholds of nociceptors, this would provide circumstantial evidence for painful consequences, even if the process does not result in tissue injury. In this case only acute pain would be evoked during the feather removal process, without being followed by sub-acute pain which is associated with tissue damage and guarding during healing. It is also relevant to note that if significant forces are applied during feather removal, then this is likely to be associated with extensive skin stretching and damage including bruising and tearing. This would be associated with acute pain during tissue trauma and also sub-acute pain (over several days) during healing. Bleeding follicles (for example, if feathers are not 'ripe' for removal) could also present a route for pathogens to cause infection.

One study (Gentle and Hunter, 1990), on laying hens, has specifically examined the potentially painful consequences of feather removal. The study was carried out in the context of potential pain associated with damaging pecking, and measured encephalographic, cardiovascular (heart rate and blood pressure) and behavioural responses to feather removal. Feather removal gave rise to a range of behavioural responses initially including struggling, wing flapping and vocalisation (and this study therefore provides us with potential indicators of pain during feather removal, see also Figure 2. Observations suggested that birds were more responsive to removal of back or tail feathers than removal of leg or breast feathers. Initial alert and overt responses were followed by periods of crouching immobility following successive feather removals. During immobility the birds periodically

closed their eyes and on the occasions when a feather was removed during immobility there was little or no behavioural response. Cardiac responses were variable with an increase in heart rate following feather removal in 61% of cases, a decrease in 20% of cases and an irregular pattern in the others. However, removal of feathers resulted in an increase in blood pressure with each feather removed in all birds, regardless of behavioural response. EEG recordings showed low amplitude, high frequency activity associated with an alert state but during the periods of immobility the activity showed a greater amplitude slow wave pattern, more usually associated with sleep or anaesthesia. Other studies have reported immobility as a response to nociceptive stimulation in chickens (Woolley and Gentle, 1987) and animals have been observed to become unresponsive and apathetic following unsuccessful behavioural responses to pain (Rutherford, 2002). Gentle and Hunter (1990) noted that the EEG activity seen in the immobile state was reminiscent of that seen in tonic immobility (Gentle et al., 1989), a catatonic-like state of reduced responsiveness to external stimulation elicited by a relatively brief period of physical restraint (Jones, 1986).

Gentle and Hunter (1990) concluded that in laying hens feather removal is painful, based on the resultant behavioural responses, cardiovascular changes and stress induced immobility. While this study examined feather removal in non-moulting birds and was therefore associated with minor tissue trauma, it clearly demonstrates that feather removal which exceeds the mechanical thresholds of skin and follicular nociceptors has painful consequences.

Pain associated with handling

Various types of handling and restraint have been related to injury and painful consequences in commercial poultry during such procedures as catching (Gregory and Wilkins, 1989) and shackling (Gentle and Tilston, 2000). Without precise details it is difficult to assess the likelihood of pain associated with handling during feather gathering, but it should be noted that pain could result from catching, handling or restraint depending on the techniques used. When handled, birds may exhibit fear related freezing (tonic immobility) rather than struggling, particularly during extended restraint. In particular, TI may be induced during inversion or dorsal recumbency, which is the position adopted during feather gathering. The likelihood of this depends on the duration of feather gathering, although TI may be induced by as little as 15 seconds of restraint (Jones, 1986). If TI is induced, while overt behavioural responses are reduced, pain may still be experienced, as birds are still responsive to external stimuli (Gentle et al., 1989) and in the Gentle and Hunter (1990) study, birds in an immobile state still exhibited cardiovascular responses to feather removal.

Pain assessment

As demonstrated in the feather removal study, pain is generally identified on the basis of probability using a variety of behavioural and physiological measurements. Experimentally, abolition of these responses by administration of analgesic agents is regarded by many as the ‘gold standard’ of evidence for animal pain (Rutherford, 2002). Assessment of the presence and severity of pain is complicated by the fact that the degree of pain felt by an individual can fluctuate over time and individuals vary in the pain they experience as a result of a particular stimulation (Rutherford 2002). In addition, external factors such as fear and stress may enhance or diminish the pain experienced and this is particularly the case during potentially painful events which include a number of different challenges, some of which may be painful or stressful and fear inducing.

Experimentally, pain associated with down removal could be examined electrophysiologically, comparing the forces required to remove down feathers in moulting and non-moulting states with mechanical activation thresholds of follicle nociceptors. Additionally, as in the Gentle and Hunter (1990) study, physiological responses during commercially relevant down removal procedures could be measured, though these would represent the total response to all external stimuli including handling and restraint. Although pain results in an HPA axis response, since this response is also shown when there is fear as part of the various consequences of handling and restraint, it does not

necessarily indicate pain. But, in circumstances where the individual is subjected to potentially adverse treatment, it does indicate poor welfare of some sort. The magnitude of corticosterone release is related to the severity of the stressor and this approach has been applied to examine the stress response to feather gathering (Nogradi et al., 2004). Because in some geese the feather gathering process is carried out regularly, evidence of learned avoidance of the procedure could also indicate aversion and thus poor welfare. Interestingly, while habituation to good handling is rapid, pain results instead in sensitisation, providing a possible avenue to distinguish between responses to different elements of the procedure.

In the field, unambiguous behavioural responses including postural changes are most often used as practical indicators of pain. Such observations range from totally subjective personal judgements to more objective detailed quantification of behaviour (Rutherford, 2002). In the context of the current issue which potentially induces acute pain, responses such as struggling, defence responses, escape attempts and vocalisations could be reliably interpreted as indicating that the gathering procedure is aversive (Sanford et al., 1986), but due to the possibility of a negative response to handling these could not be attributed specifically to pain. However care should be taken in relying heavily on overt behavioural responses as indicators of pain as geese are restrained during feather gathering. This is likely to directly limit their behavioural opportunities as well as possibly inducing an immobile/TI like state, as seen in the Gentle and Hunter (1990) study, which may mask or reduce the visibility of behavioural responses associated with poor welfare. In addition, there is evidence in various species including birds that attention-based cognitive coping strategies have potentially analgesic consequences. Therefore it must be recognised that changes in motivation including fear and stress can reduce pain related behaviours by altering the attention of the animal away from pain (Gentle, 2001). Collectively, these factors potentially limit the value of relying on simple behavioural indicators of pain and distress during routine observations of feather gathering.

2.3.3. Assessment of stress during feather harvesting in geese

Any animal's fear and stress responses, most of which indicate poor welfare, are a result of a combination of biological defence responses, including behavioural responses (escape or immobility), autonomic nervous system responses ('fight or flight'), neuroendocrine responses (hypothalamo-pituitary-adrenal (HPA) axis) or immune responses (immunocompetence), and these are well established in avian species. These physiological indicators provide routes through which we can detect rapid changes in endocrine response which indicate stress, and in the case of glucocorticoids, some indication of the severity of the stressor. However, before meaningful measurements can be made, some important practical issues must be considered. To measure plasma indices, a blood sample is required and it must be recognised that the act of measurement itself (e.g. handling and restraint) could trigger a stress response. It should also be noted that the timing of sampling must be carefully controlled as baseline levels of some compounds are subject to diurnal change (e.g. cortisol). The rapidity of some responses and their decay also has implications for how quickly the sample must be taken following the stressor. Studies using repeated measures have to contend with both measurement induced stress and timing issues, but can be overcome with careful experimental design. The use of non-invasive techniques (e.g. samples from urine or faeces) has been used in geese (Koch et al 2009) to avoid some of these problems, but it loses control over when the sample is produced. Another challenge in the measurement and interpretation of stress responses is that large and consistent individual differences are seen in the way that individual animals deal with stressors. It has been suggested that responses are influenced by 'personality types', which are associated with consistent behavioural and physiological differences. These differences have also recently been demonstrated in geese (Pisa et al 2006; Kralj-Fiser et al 2010). In addition, the physiological or motivational state of the animal may influence the stress response with animals more vulnerable to stressors at certain times. For example, it has been suggested that geese may be more susceptible to stress at the time of moulting, which is highly relevant.

During acute stress survival is the imperative and the animal will do all it can to escape from or eliminate the threat. It will use existing reserves to do this, provided that these exist, but there may be other biological effects, for example on ovulation. Feather gathering is normally repeated at 6 week intervals and it is worth noting that if an acute stressor is repeated, the nature of the stress response elicited depends on its intensity, duration, number of applications and frequency of application. The nature and severity of the stressor is also important, as this will influence the likelihood that the animal will become habituated (stop responding with repeated exposure) or sensitised (respond more strongly with each repeated exposure).

Physiological indicators of poor welfare may be usefully employed and interpreted in their behavioral context, to compare the strengths of similar stressors (e.g. handling and gathering versus handling alone) and help us to determine the severity of a stressful procedure. This approach has been recently employed in a study specifically designed to examine the stress response to gathering feathers from geese (Janan et al., 2003). Plasma corticosterone was measured in groups of 5 geese assigned to five treatments (control; feathers gathered; feathers gathered after 'anti-stress' treatment – amino acids and vitamins added to drinking water for 5 days before treatment, 'sham gathered' – handled as if gathering, but no feathers removed; and sham gathered with 'anti-stress' treatment). The geese were blood sampled before the treatments, during gathering or sham gathering and 5 minutes, one hour and three hours later. The results showed that the level of corticosterone in the plasma was high in the first (baseline) sample, and subsequently fell before being elevated again at 1 and 3 hours after treatment. This pattern was seen across the groups, regardless of treatment. The high baseline corticosterone levels observed are likely to be related to pre-sampling herding and handling, and the reductions seen during gathering or sham gathering may reflect that stationary restraint is less stressful than the catching process. In all groups a delayed elevation in plasma corticosterone (at 1 and 3 hours after gathering/sham gathering) was apparent. Unfortunately, the small sample sizes in this study (n=5) do not allow conclusions to be drawn about whether feather gathering induces additional stress compared with handling alone. Given that controls, sham harvested and harvested birds showed similar patterns of corticosterone release, it is likely that the data illustrate a generalised response to handling. In contrast to these negative effects of handling, recent work has suggested that gathering feathers stimulates the immune system (Járvás et al., 2008).

3. CONDITIONS UNDER WHICH THE PRACTISE OF HARVESTING FEATHERS FROM LIVE GEESE IS CARRIED OUT

3.1. Overview of goose husbandry and utilization

The greylag goose (*Anser anser*) is the ancestor of domesticated geese (*Anser anser domestica*) and domestication probably took place in Egypt about 3000 years ago (Buckland and Guy, 2002). The Chinese and African geese are probably descended from swan goose (*Anser cygnoides*). According to some literature, geese were domesticated in Babylon about 4000 BC (Ámon, 2004). Thus, goose production has been a traditional activity in animal production for centuries all over the world. Geese have been raised for meat, fatty liver (foie-gras) and feathers. With geese, the feathers can be gathered from live birds, so feathers are secondary products to the meat.

In Europe, the major production is in Poland and Hungary, and previously in Germany. In Hungary the production is focused on meat, foie-gras and feather production, while in Poland the production of foie-gras is forbidden. Since the 1980s Hungary became the second exporter of down and feathers after China (see Appendix 3). Down and feathers are used for high quality clothing, pillows, sleeping bags and quilts. In 1994, 70 % of the total goose population was in small-holders' hands, with 40 geese on average, whereas modern large scale farms may have a population of 14000 geese.

3.1.1. The effect of domestication and selection of geese on feather production

The quantity and quality of feathers has been changed as a result of domestication and selection work. It is mainly manifested in the process of feather maturation and moult frequency. With wild geese the first "true" feathers begin to emerge at 3-4 weeks of age. They attain full maturity by 11 weeks of age followed by a subsequent moult. It is only a partial moult that will be completed by 18 weeks of age. Older wild geese moult only once a year after the termination of the incubation period (Schneider, 1995).

The practice of gathering feathers in association with the natural moulting of domestic geese has a long historic past of about 2000 years. Already Columella, a well-known old Roman writer, reports in his work "Rei rusticate libri XII" (About Agriculture) about the fact that geese can be plucked twice a year, in spring and autumn**,** and he also recommends to keep geese of white plumage for breeding purposes (Columella, 2005). The "Hungarian Encyclopedia" published in 1653 also carries information about the fact that geese can be plucked twice a year (Apáczai Csere, 1959). According to another Hungarian agricultural work, published in 1830, feathers can be gathered from geese over 3 years of age 3-times a year: in April, July and late-September (actually on day of St Michael, 29 of September) provided that birds are fed more abundantly at these times (N. Nagyváthy, 1820).

According to Hungarian authors of technical books in the 20th century, feathers can be gathered from growing geese twice (Winkler, 1920) or 2 to 3-times a year (Hreblay, 1901; Lacza, 1962). In the case of older geese, the recommendation has decreased from 4-5 times (Hreblay, 1901) to 3-4 (Lacza, 1962), down to 3 times per year (Pálffy, 1980). These decreases in the number of occasions are closely related with the switching over to the egg-production.

The between gathering interval may also vary considerably with the keeping and feeding conditions, as the plumage requires 6-10 weeks for regeneration (Báldy, 1961). Previous works date the first feather gathering from growing geese to the end of the 10th week (Winkler, 1926), to 10-12 weeks of age (Tóth-Baranyi, 1957; Pálffy, 1980), or to 8-10 weeks of age (Báldy, 1961, Bogenfürst, 2000). Abundantly nourished geese can be subjected to the procedure every 6 weeks, but under poor nutrition conditions this interval can be longer (Lacza, 1962).

In a selected Hungarian Upgraded Goose flock (kept at the Goose Breeding Research Station of the Gödöllő Agricultural University), an h^2 of 0.47 has been obtained for the feather production ability (Tóth, 1989). This h^2 of medium degree indicates, at the same time, a potential for additional selection for feather production and elite birds have been selected as breeding birds (Kozak et al., 1995). Therefore, environmental factors seem to affect the feather production to a greater extent than the genotype.

3.2. Scenario of geese production in commercial practice

Housing and management

Recently hatched goslings are placed in a brooder, with soft dry litter and a temperature of about 32 ^{o}C decreasing over the next 3-4 weeks to ambient temperature. It is important that the heat sources be started heating at least 24 hours before the goslings arrive. The building can be used for gosling providing it is dry, clean and free of draughts and vermin. Even during the brooding period when the goslings are two weeks of age, they can be let out to graze, provided the weather is warm and it is not raining. This can reduce the building space requirements per gosling. Goslings are harmed by heavy, cold rain until about five weeks of age, since before that they do not have sufficient feather cover to protect them (Buckland and Guy, 2002).

Adult domestic geese only require shelter from the worst weather, wind and stray or wild animals, e.g. dog, fox. Generally the geese are kept in deep litter systems, usually with access to a yard, and occasionally an artificial bathing area. However, they may also be kept on a raised floor of wooden slates, plastic slats, heavy wire mesh or expanded metal.

Breeder flock management

Healthy goslings are selected at the hatchery and the decision is taken whether the goslings will be kept for breeding or will be used for meat or fatty liver production. Goslings to be kept for breeding stock are sexed, and marked at day old by incision or perforation of the foot web and a family numbered, metal or plastic tag attached to their wings.

Prior to egg laying feathers are gathered three times at 6-7 week intervals. Feathers are first gathered at 9-10 weeks of age, when they are ripe. The geese usually start their first laying cycle of egg production at the end of January in response to the increasing day-length (Figure 3).

At 19-26 days of age they are vaccinated against goose parvovirus (Derzsy's Disease) (Figure 3). One month before the start of the egg laying period the geese are re-vaccinated against goose parvovirus. This may be repeated at the middle of egg production (end of March and first days of April), the times depending upon the vaccine used.

The spring egg laying cycle ends at the end of May, when the daylight is longer than 14 hours. This is a consequence of photo refractoriness and has been observed in most photosensitive birds. At this time egg production declines markedly and ends with regression of the ovaries and the geese moult. Since the feather gathering process coincides with the natural moulting, the feathers from the breeding stock are gathered at the end of May (Figure 3).

It is a common practice to generate a second egg laying period using light programmes. A so-called second (autumn) cycle is induced in geese. This involves a 3 weeks rest period and then they are kept in continuously dark rooms with a light intensity less than 0.1 lux. In darkness they are supplied with restricted feed (180 g/goose/day). Ganders are kept in darkness for 20 days and layers for 40 days. Supplementary lighting induces the second (autumn) cycle of egg production. In commercial practice 3-4 geese are together in a group with one gander. Before the second cycle of production the geese are vaccinated according to the procedure mentioned in the spring cycle.

If the breeding geese are not kept for a second egg laying cycle, feathers are gathered every 6-7 weeks (Figure 3). This process is repeated 3 times as long as the weather is adequate for gathering. They are then kept for a new spring egg lay cycle.

Reproductive flocks in Poland are kept in accordance with the technology of the National Research Institute of Animal Production. This concerns the lighting programme, the nutritive value and daily feed allocation, the breeding treatments, the vaccination, etc… The reproduction of the White Kołuda® geese (which make up 98% of the population of geese in Poland) begins in the second half of January or in the first half of February and lasts until around the end of June. After the laying period, gathering of the ripe feathers is carried out. The proper time to gather feathers can be recognized by the presence of shed feathers.

Feather production in meat geese

Historically two types of meat production are recognized. One is the roast goose, which is slaughtered at 8-10 weeks of age. The second type, called the meat goose, has its feathers gathered 2-4 times, followed by 3 weeks of fattening before going to slaughter (Figure 4). In Poland, feathers are not gathered until 25 weeks of age.

Feather production of fatty liver (foie-gras) geese

Fatty liver production is the process of force-feeding (gavage) geese, which normally takes place between 9-25 weeks of age, for a period of 16-18 (young) - 18-22 (old animals) days. Feathers are not

696 gathered from young goslings which are force-fed at the age of 9-10 weeks, but feathers are gathered
697 from the older geese one or more times (Figure 4) before they start the process of force-feeding.

Figure 3. Breeding geese - rearing until the end of first egg laying

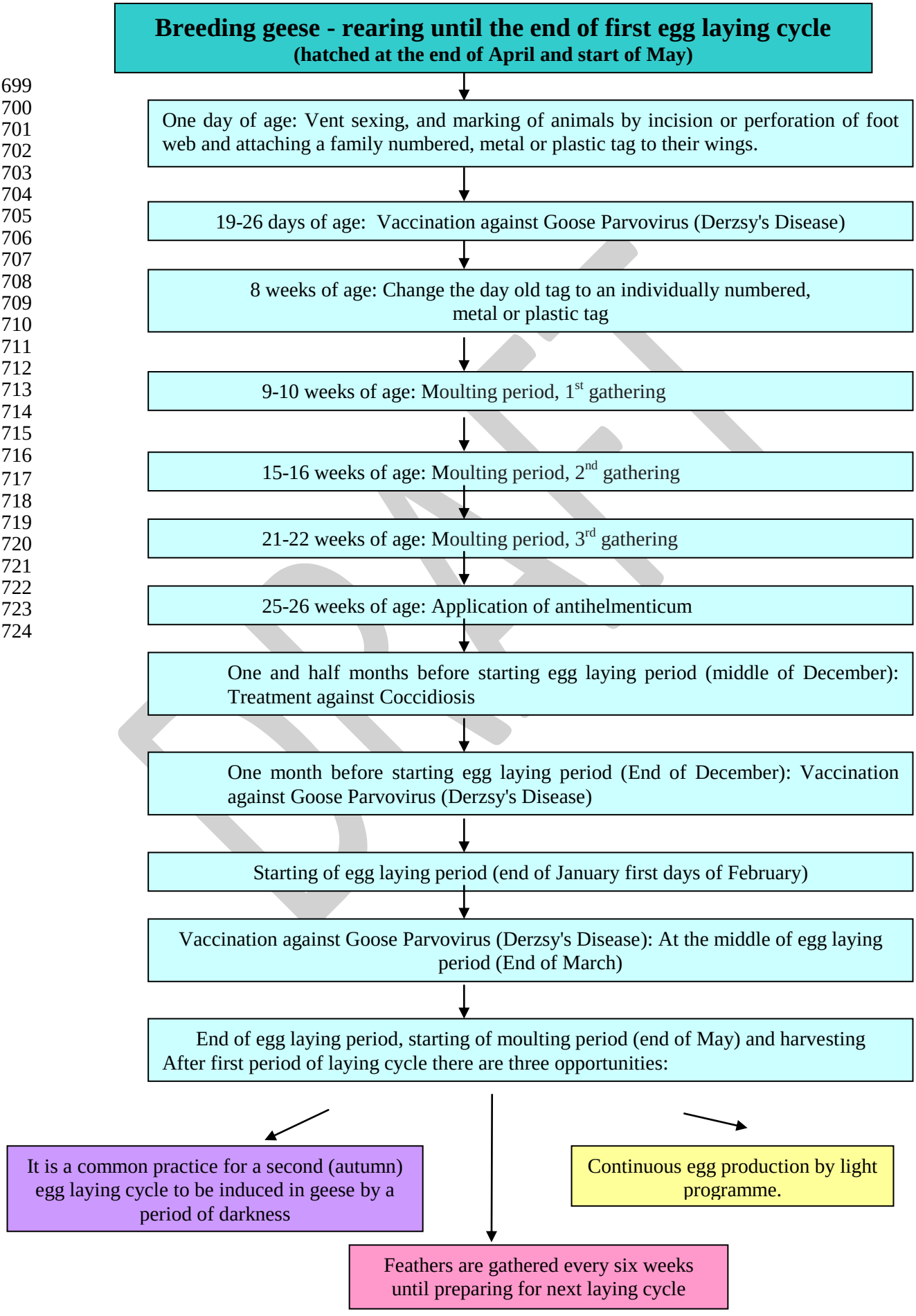
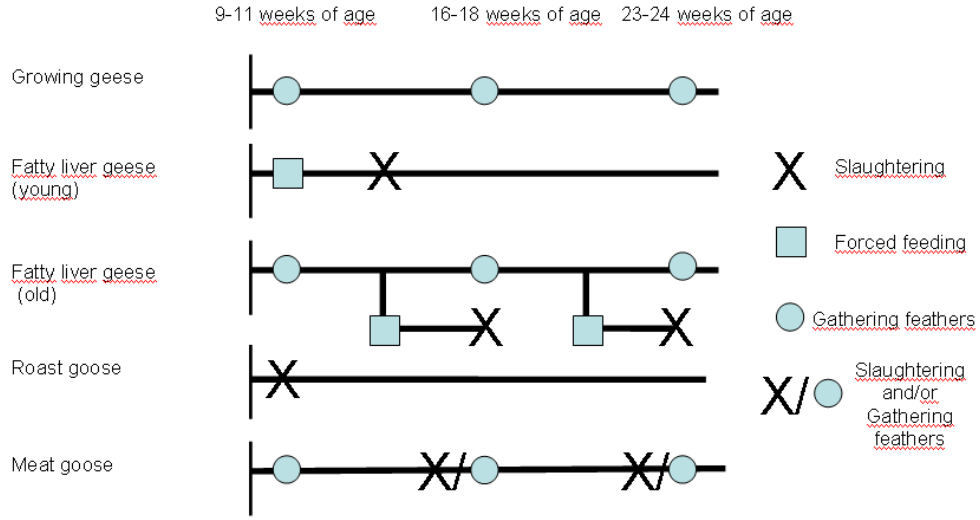


Figure 4. Gathering of feathers from live geese



3.2.1. Environmental and personal conditions

The gathering of feathers from live birds is generally carried out in enclosures such as stock barns, summer quarters, or tents (Bogenfürst, 1992) in cool, well-ventilated and draught-free environments (Szentirmay, 1968). Feathers can only be gathered during dry, warm weather conditions (Pálffy, 1980) and so it is a seasonal activity. The first and the last gathering of feathers occurs when the average daily air temperature is approximately +15°C and the minimum temperature greater than +6°C [32/1999.(III.31.) FVM r.]. It is prohibited during adverse weather conditions (MÉM, 1975). Partly de-feathered geese are protected from cold (Ádám, 2001) since if they get cold in cool, windy and rainy conditions, their resistance may be weakened (Pálffy, 1980). Disturbing the animals may increase the stress, making the removal of feathers more difficult due to the spastic contraction of the feather quill (Schneider, 1991). It is therefore desirable that the conditions of harvesting do not shock the animals (Ádám, 2001).

As far as possible the gathering of feathers is performed by skilled persons so the procedure is completed in a short time (Héjja, 1984). In Poland the people who carry out feather gathering are required to attend courses including information about animal behaviour. Education of people handling geese includes elementary information on minimisation of fear and anxiety caused by people and the innate human-geese interaction. In order to prevent diseases, the workers wear clean, disinfected work-clothes and footgear and use only disinfected tools in the farm [41/1997. (V.28.) FM r.; 32/1999.(III.31.) FVM r.]. Also care is taken regarding the personal hygiene of workers and cleanness of the harvesting room [32/1999.(III.31.) FVM r.].

The feathers and down removed from geese can be collected in baskets (Szentirmay, 1968) or on canvas or foil spread on the floor of the building (Bogenfürst, 1992).

3.2.2. Preparation of geese for harvesting

Geese are fed more abundantly one week prior to the harvesting procedure (Országos Szabvány, 1989) and an “anti-stress” diet (higher protein, minerals and vitamins) is given during the three days prior to gathering the feathers (MÉM, 1975). It is also recommended (as far as possible) to bathe or swim the geese in clear deep water (Szentirmay, 1968), and to allow them to dry (Ádám, 2001) on two consecutive days beforehand. The geese are then kept in a clean building on dry, fresh bedding

(Országos Szabvány, 1989) or on pasture (Bögre, 1981). The aim is that the geese to be subjected to the feather gathering procedure have a dry and clean plumage (Bogenfürst, 1992, Pálffy, 1980).

The geese are not fed in the evening prior to the day on which the feathers will be gathered or in the morning of the feather gathering day (Schneider, 1991). This will result in an empty digestive tract by the time of the feathers are gathered and the geese will better tolerate the procedure, without contaminating their plumage with droppings.

3.2.3. Organisation of harvesting

The number of staff is adjusted to the size of the goose flock, so that the feather gathering is completed in a flock of similar age within 1-2 days (Szentirmay, 1968), or at least within 3 days (Bögre, 1981). A protracted duration results in greater individual differences in the maturity of the feathers, making it difficult to determine the right time for the subsequent feather gathering from the flock (Bogenfürst, 1992).

Electric machines to gather feathers have been developed, but birds are frequently injured (Bakos, 2009; Vier Pfoten, 2009). Such machines are forbidden in Hungary.

For large goose flocks, a "harvesting brigade" is organised. The working brigade consists of several groups performing different processes.

Members of the catching group catch the geese from the flock and give them to the assisting workers (Szentirmay, 1968). Preferably, some 30-50 geese are driven into the part of the building assigned for catching (Bögre, 1981) or into a corner of the building using a catching frame (Szentirmay, 1968). The catching frame facilitates the safe separation of smaller groups without injuries (Schneider, 1991), by avoided the whole flock running into the corner and tramping on each other (Bögre, 1981).

A goose is caught by grasping the goose firmly by the neck with one hand, leaving the other hand free to reach over its back, encircling the body and wings (Bartlett, 1986, Grow, 1972), and then lifting the bird. The lifting of geese by the neck is prohibited to avoid pressure on their windpipes [32/1999. (III.31) FVM r.] and they are never carried by their legs, like chickens, as this may lead to injury. The caught birds are handled calmly until they begin to thresh their wings (Szentirmay, 1968). When the goose threshes its wings too strenuously it may be controlled by thrusting its head under its body. Geese may also be carried by the wings or neck but, when carrying the bird, its weight should always be supported by one hand and arm and its legs held together. The other hand can be placed across the animal's back, or can hold both wings together. The bird is carried under the arm with the head and neck protruding back under the operator's arm (Ashton, 1999). It is prohibited to tie up the wings of the goose or to suspend the goose with its legs tied up (Schneider, 1991).

Members of the assisting group take the geese from the catching group and transport them to the people who will gather the feathers and afterwards, they take them to the resting place or release them in a separate place where birds can find water and feed (Bögre, 1981).

Members of the feather gathering group are skilled labourers (Szentirmay, 1968). The person who is sitting on a chair takes the goose in his or her lap, positioning the bird dorsally so the front of the goose is close to the body of the operator and its rump over their knees. The neck of the goose is gently thrust under its body and between the knees of the operator. The legs of the goose are held together by one hand and turned toward the back. The wings of the goose are placed by the operator between his or her thighs. With the free hand the operator gathers the feathers, starting usually at the belly, around the cloaca and moving forward the crop (diverticulum of the windpipe). The feathers and down are removed at the lower belly, the flanks and the areas not covered by the wings.

Subsequently, the operator turns the goose on its ventral side, and removes the feathers from the back. Feathers are removed in the direction of growing, and not against it, as this results in tiny skin fragments being pulled away, even with ripe feathers (Szentirmay, 1968). Cover feathers and down are gathered together. The excessive removal of feathers is not desirable; some down should be left on the trunk and the lower belly (Bögre, 1968), i.e. down feathers are thinned out only (Schneider, 1991; [32/1999. (III.31) FVM r.]. The feathers covering the crop and the feathers supporting the wings (situating under the wings), the leg feathers (Tóth, 1956) as well as the wing- and tail feathers are not gathered. The geese deprived of their wing feathers and wing-supporting feathers will keep their wings dangling for several weeks (Pálffy, 1980) and their health may also be compromised (Bögre, 1981). The wing feathers are saved because they protect the back of the goose from rain, cold and sunshine. The wing-supporting feathers are known to play a role in keeping the wings in a normal posture. Geese that have too many feathers removed show a lack of appetite, apathetic behaviour (Schneider, 1991), weight loss, failing health and even fever (Pálffy, 1980).

Workers can not use rubber 'finger protectors' or gloves, nor can they wet their hands in order to work faster. These restrictions are imposed because operators using these cannot "feel" the procedure in their fingers, and the wet hands may result in additional increases in the moisture content of the feathers (Szentirmay, 1968).

It is not at all unlikely that some specimens of already moulted, pin-feathered or of renewed plumage may occur in the goose flock, especially among breeder geese having terminated their egg production. However, it is necessary to perform the gathering in order to ensure a uniform feather maturity of the flock by the next occasion. Feathers are not gathered from geese already having new plumage (Bogenfürst, 1992).

The gathering of feathers at an inappropriate time may damage the flock, and retard its development. It is also associated with a lower quality of the plucked feathers, resulting in a product of inferior value (Ádám, 2001). In the case of gathering the feathers too early, the feathers are still sticking closely in the follicles and the pulps of the quills contain blood vessels, thus the pulling out of these feathers may cause dermal injuries. The wounds may result in a lack of appetite, weariness or wound-fever, and decreased resistance leading to risks of infections and even death. Gathering feathers after the optimal time also involves risks and is performed with increased care to avoid removing the newly grown pin feathers. The scantly grown feathers have full-blooded follicles and their accidental plucking will cause bleeding (Szentirmay, 1968).

Members of the feather treating group take the feathers and down and prepare the raw material for transportation. When storage is needed, they keep the material in dry and cool environment and toss the feathers daily on 5-6 occasions. In case of daily transportation facility, they pack the feather material immediately in bags and store it until its actual transportation (Szentirmay, 1968).

A skilled worker - with appropriate organisation and the help of the assisting group can pluck 40-80 geese an average over an 8-hour working time (Bögre, 1981). Although this number varies according to the age of the geese (Szentirmay, 1968). The gathering of feathers from growing geese is quicker than that from adult geese (Szentirmay, 1968), as the labour input is naturally affected by the body size of the geese, which in turn is related to their age. Ten minutes per goose can be used as a guide, although for a skilled worker this may be reduced to 6 minutes per goose (Schneider, 1991).

3.2.4. Housing and managing geese after harvesting

During the first week after feathers have been gathered, the geese are protected from getting cold, from strong sunshine, steady rainfall and extreme weather conditions (Bögre, 1968). They are therefore kept in quarters covered with a roof (MÉM, 1975) preferably in barns, for about three days (Schneider, 1991) and provided with abundant bedding. They can be released on water, even in warm

weather, only 10-12 days later (Ádám, 2001). Birds usually avoid bathing for about a fortnight (Schneider, 1991) and are not walked long distances (Bögre, 1968).

Geese are given an "anti-stress" diet for three days post-harvesting (MÉM, 1975) and fed more abundantly for about two weeks (Országos Szabvány, 1989). During the week post-feather gathering, they are fed ad libitum - 300g/goose/day – (Bögre, 1981), because the replacement of the removed feathers requires a higher rate of metabolism (Szentirmay, 1968). Geese require proteins in adequate quantity and quality, and especially the sulphurous amino acids notably, cystine and methionine for feather growth (Bogenfürst, 1991). This protein requirement can be satisfied by feeding high protein concentrates in addition to grazing (Bögre, 1981). As a general experience, a goose from which feathers have been gathered, consumes 1 kg more feed than a goose that has not had feathers removed (Schneider, 1991). The possible skin injuries arising during the gathering of feathers are treated (Bogenfürst, 1992). Geese subjected to veterinary treatments are kept separately to promote recovery [32/1999.(III.31.) FVM r.].

3.3. Quality Assurance in feather harvesting

Standards for feather gathering have been prepared (Bogenfürst et al., 1997).The essential parts of the document are integrated in this Report where the practice of gathering has been explained (see section 3.2.3.). The following of these standards is voluntary. Few flocks followed the standards.

According to the current Hungarian regulation, data obtained during the pilot phase and the actual gathering should be recorded and stored for at least five years. The records should include the identification number of the flock, the date of gathering of the feathers, the persons involved and the number of geese (REF: [32/1999. (III.31.) FVM r.]).(see appendix A). An audit can be performed at any time, but at least once a year, and the Minister of Agriculture and Rural Development shall be informed of the results obtained until 31 January every year 20/2002 (III.14.) FVM r.].

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APPENDICES

APPENDIX 1 ANNEX 5 OF DECREE 32/1999 ON THE PLUCKING OF GEESE

Decree 32/1999 (III. 31.) of the Hungarian Minister of Agriculture and Rural Development introducing animal welfare regulations concerning animals kept for farming purposes

As amended by

Decree 20/2002 (III. 14.) of the Minister of Agriculture and Rural Development on the amendment of Decree 32/1999 (III. 31.) of the Minister of Agriculture and Rural Development introducing animal welfare regulations related to the keeping of animals for farming purposes

Annex 5

Regulations on the plucking of geese

1.1. Plucking shall mean the humane, painless and professional removal of mature feathers and down.

1.2. The following regulations comprise an appropriate regulatory framework for utilising the special biological characteristics, i.e. moulting of domestic geese to obtain down and feathers. It shall be applicable to the plucking of all geese – irrespective of strain, utilisation category, age and sex – which are plucked alive for the purposes of obtaining down and feathers.

2. The following rules apply to the plucking of geese to obtain down and feathers:

2.1. animals may only be plucked at certain times, when the feathers are fully mature;

2.2. plucking shall be carried out in dry and warm weather to prevent the animals catching a cold afterwards, and should the weather turn cold, the geese shall be kept in a sheltered warm place after being plucked.

2.3. wherever possible, geese shall be given the opportunity to bathe and swim on the day preceding plucking, and kept in a clean pen with fresh litter until plucking commences.

2.4. plucking may not be commenced while the feathers of the animals are still wet;

2.5. in the one week preceding and in the two weeks following plucking, animals shall be given 20% more feed;

2.6. when plucking, in order to avoid hurting the skin and the feather's shaft becoming bloodied, feathers shall be plucked in the direction they lie;

2.7. feathers with a rigid shaft (wing and tail feathers) may not be plucked, and when plucking the body, care shall be taken to leave enough feather which holds the wings and enough down to ensure that the animal is capable of regulating its body temperature.

3. In order to protect geese from adverse weather conditions, apart from an open-air pen of sufficient size, they shall be accommodated in a well-lit barn with good ventilation at least from the second day before plucking to the fourteenth day after.

4. The barn, the floor of the open-air pen, as well as litter shall be kept dry and clean.

5. Geese shall be accommodated in an environment which is in accordance with the characteristics of the species and which allows them to satisfy their needs with respect to movement, eating and drinking.

6. When plucking geese, steps shall be taken to ensure that it causes as little stress as possible. Vitamins and premixes help geese to endure the anxieties involved in plucking without suffering damage.

7. The first and last day suitable for plucking in a season shall be a day with at least 15 °C daily average temperature and with a minimum temperature above +6 °C.

8. Plucking live animals may only be carried out in periods when birds are shedding their feathers (moulting) as a normal physiological process. Young birds may be plucked again 6-7 weeks after the first plucking. Depending on rearing conditions and the weather, young birds may also be plucked a

third time 6-7 weeks after the second plucking. It is advisable to first pluck adult geese only after the laying period is over; further plucking may be carried out as specified for young geese.

9. To determine the exact time when feathers are mature, test plucking on the breast, sides and back of the animals shall be used. With respect to breeding stocks, the frequency of test plucking shall be increased towards the end of the laying period. When stocks are grouped by plucking time and if this grouping is maintained, it is enough to determine the ideal plucking time for the first group and align the rest appropriately.

10. Feathers are mature when the connection between the rachis and the papilla has become fully relaxed, allowing feathers to be plucked from the papillae without difficulty or pain, and when the end of the feathers has fully keratinized, the feather has become a dead accessory and is no longer nurtured. When feathers have matured, as a sign of moulting, feathers shed by the geese start to appear in premises used by the animals (barn, pen, grazing field). This is the time when it is necessary to check the maturity of feathers and start plucking, as described earlier.

11. During plucking and afterwards, special care must be taken to cause as little stress to the animals as possible, as stress has a negative effect on the general well-being of geese and therefore causes feathers to fit tighter in the shaft. To avoid this, geese must be plucked in a calm environment.

12. The animals shall be caught using an appropriate grid suitable to isolate a few geese. Geese then shall be caught by their necks. The trachea may not be squeezed; therefore, geese may not be listed by their neck. The following rules shall also be observed:

12.1. geese may only be lifted if their weight is held by the other hand;

12.2. it is forbidden to tie the wings together, to cross the wings, or to suspend the animals by their tied legs.

13. Persons carrying out plucking shall avoid causing any pain or injury. Feathers and down shall always be plucked in small clusters, and emerging new feathers may not be plucked, as it would hurt the geese and would also significantly lower the quality of feathers and down, due to the decay of bloodied feathers. Persons carrying out the plucking may not moisten their hands while doing so.

14. The areas which may be plucked are the breast, abdomen, back and sides. The plumage covering the dilated part of the oesophagus, the wing feathers, tail feathers and the supportive wing feathers may not be plucked. Unlike feathers, down may only be thinned.

15. Animals may only be plucked by staff with the necessary skills and experience. For the protection of the animals' health,

15.1. any injuries on the skin of the animals caused during plucking shall be treated with veterinary medicine, and the affected animals shall be isolated to ensure that they can rest and recuperate;

15.2. individual animals which are hard to pluck due to stress or other factors shall not be plucked;

15.3. to prevent diseases, plucking staff may only enter the room where plucking takes place in clean, freshly washed clothes and shoes, and attention shall be paid to their personal hygiene as well;

15.4. the cleansing of the plucking premises shall be ensured.

16. Records shall be maintained of the test pluckings and pluckings (including the ID of the stock, the time of plucking, the persons carrying out the plucking and the number of animals plucked); the records shall be preserved for at least five years.

APPENDIX 2 FEATHERS TAKEN AT DIFFERENT TIMES OF DEVELOPMENT UNTIL SECOND HARVESTING

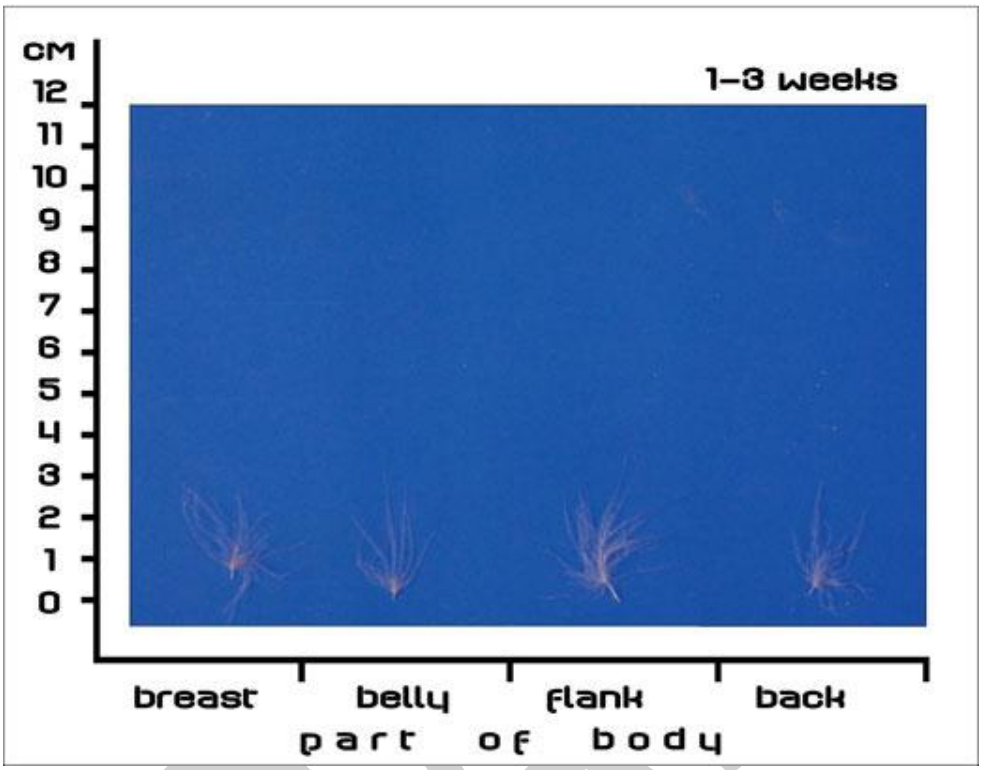


Figure1: Natal downs sampled from four body parts of goslings between 1-3 weeks of age

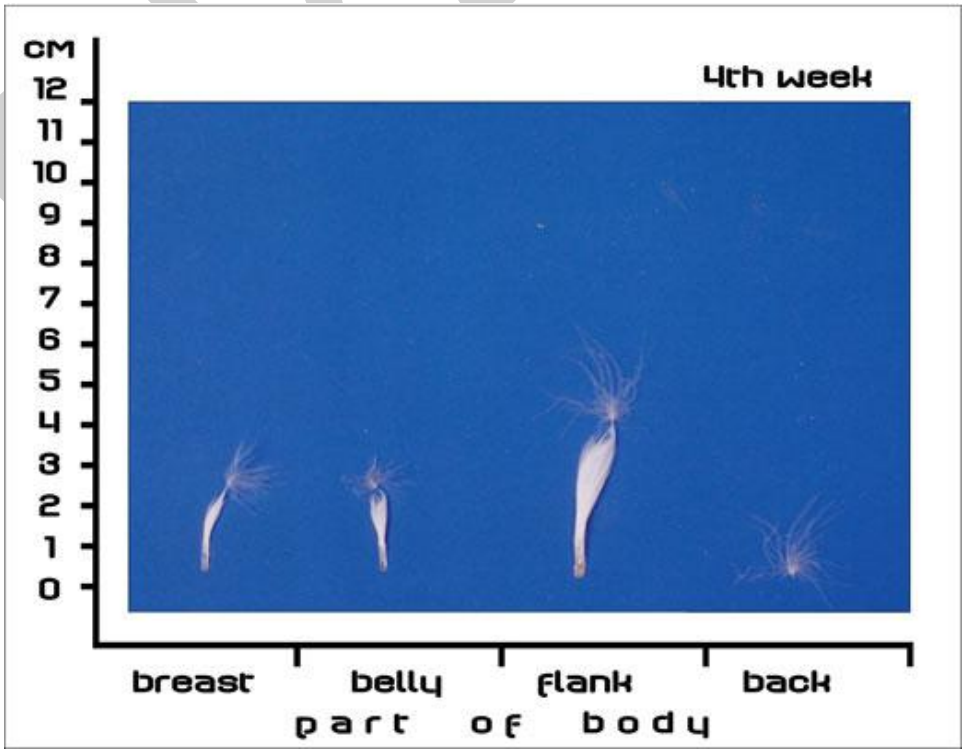


Figure 2: The first moult begins on the belly: the natal down is pushed out by the tips of the new feathers

Figure 3: The natal down are carried out on the tips of the incoming juvenile feathers in the first moult, but soon abraded

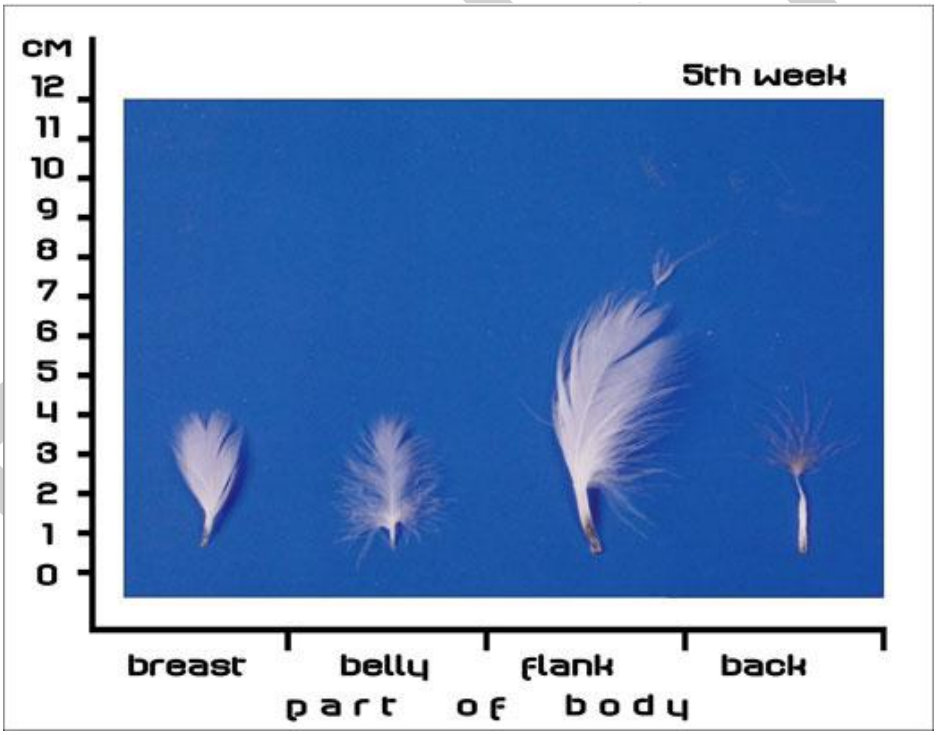


Figure 4: The mid part of the back undergoes moult at 5 week of age

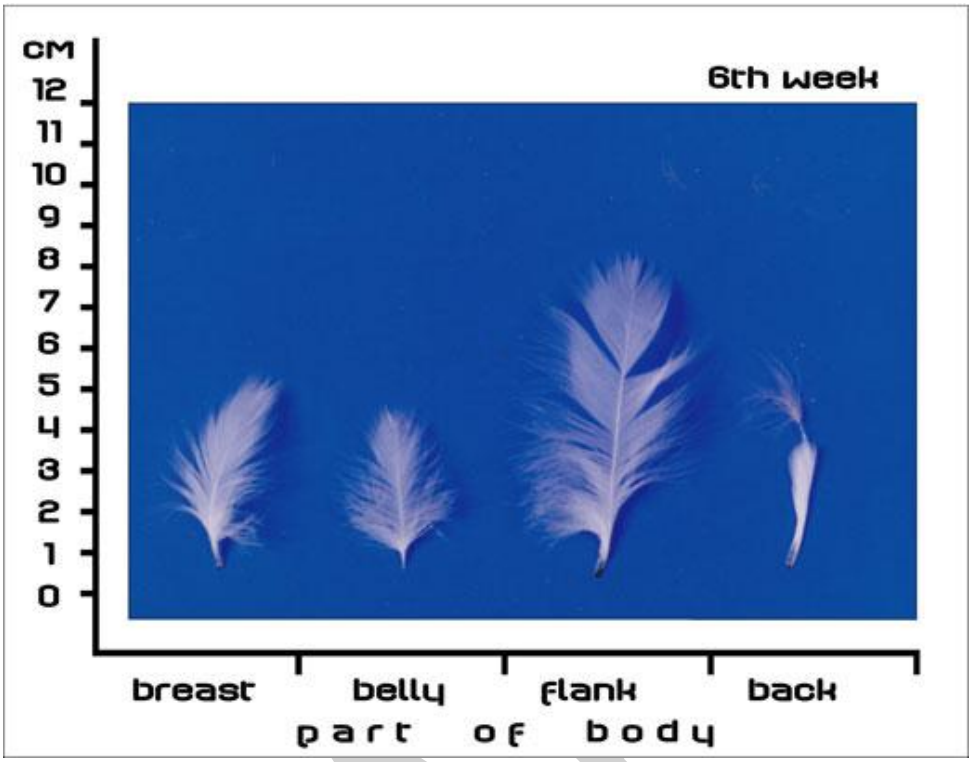


Figure 5: The new cover feathers arrive in intense growth phase

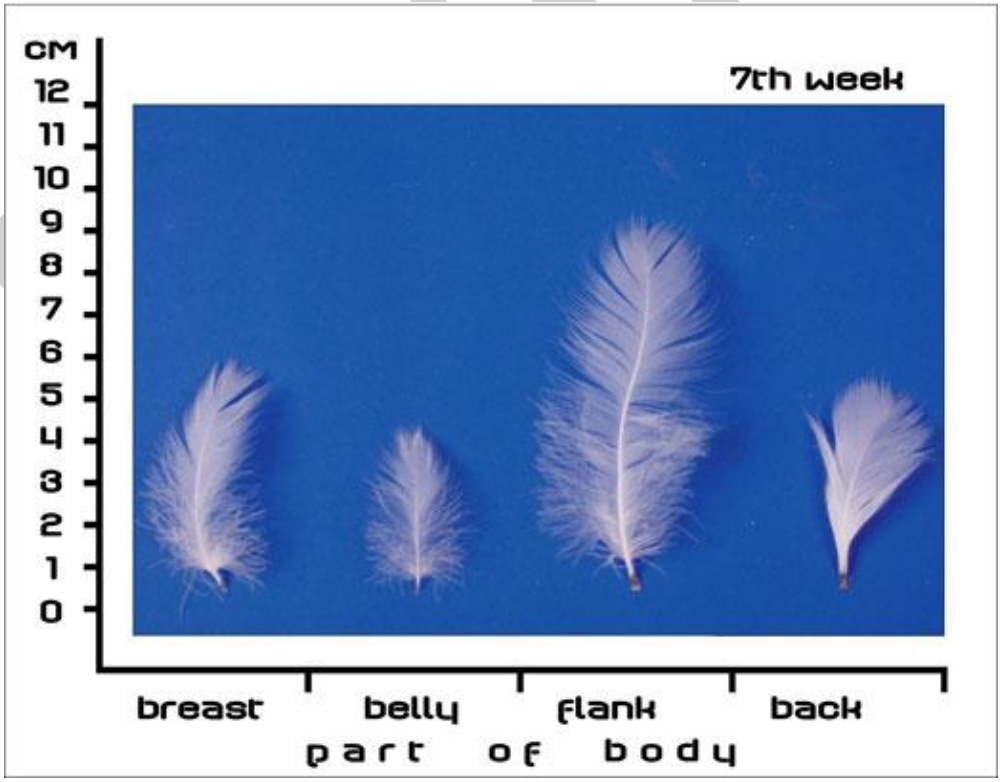


Figure 6: The feathers in all four body parts grow at a highest rate at this age

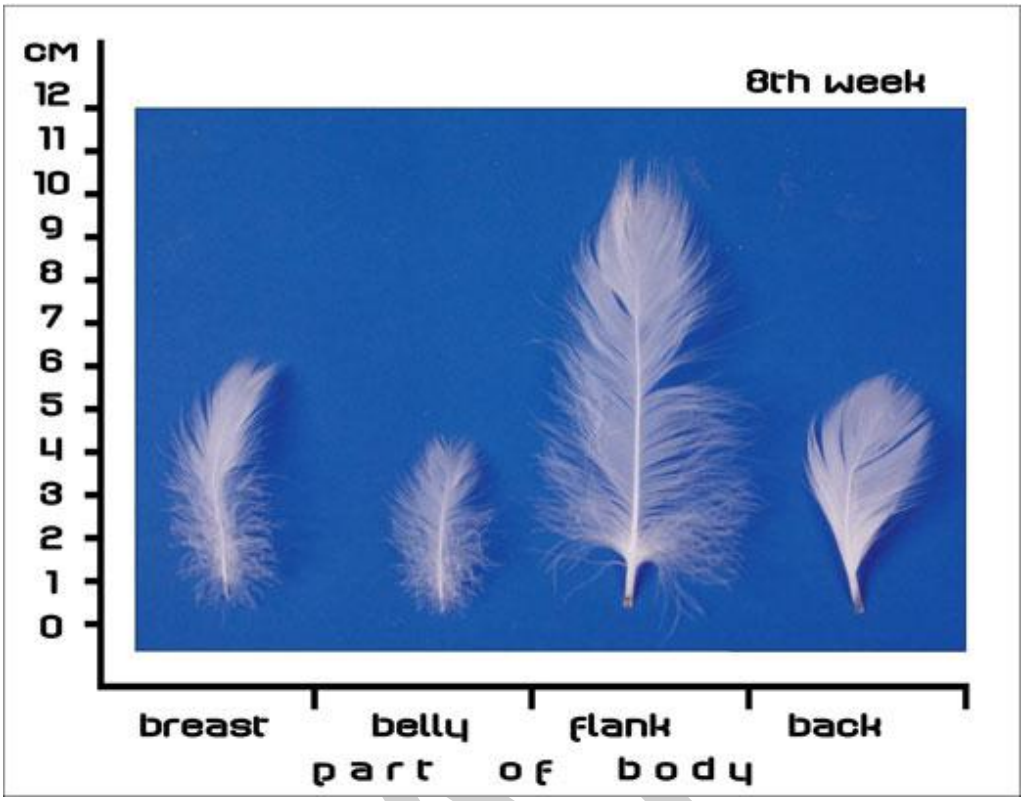


Figure 7: The juvenile feathers are still in phase of intense growth

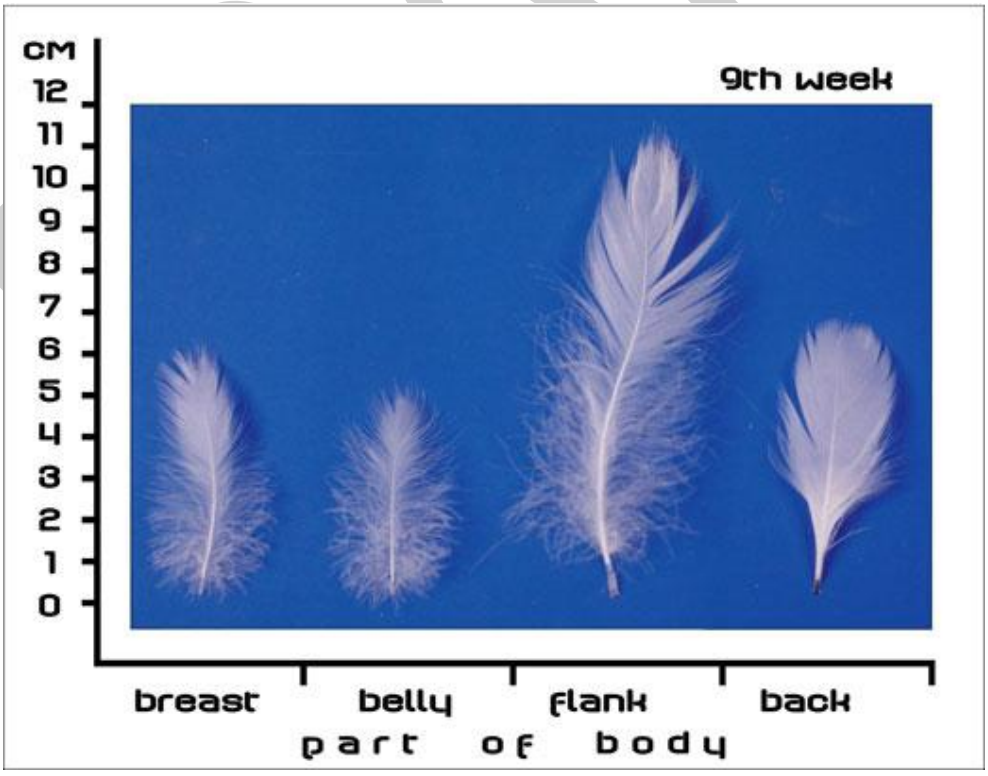


Figure 8: By this time, the belly feathers are already mature, and feathers in other body parts elongate also little

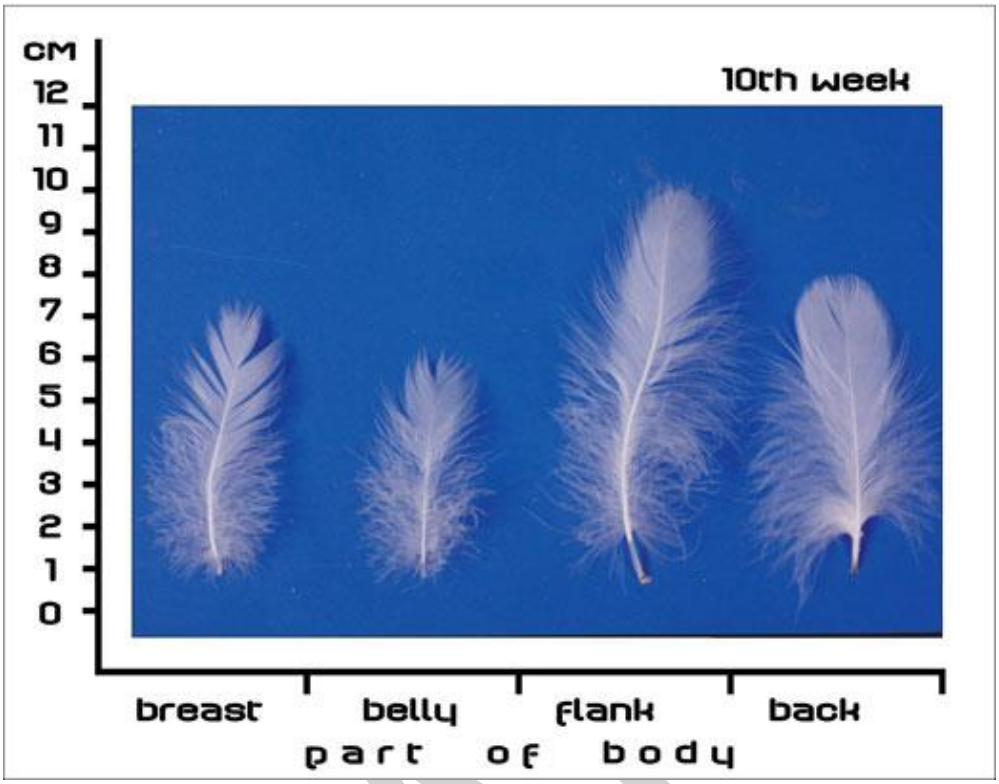


Figure 9: The feathers covering the back are still immature

Figure 10: The new follicles (under the line) are already formed under the old ones (above the line)

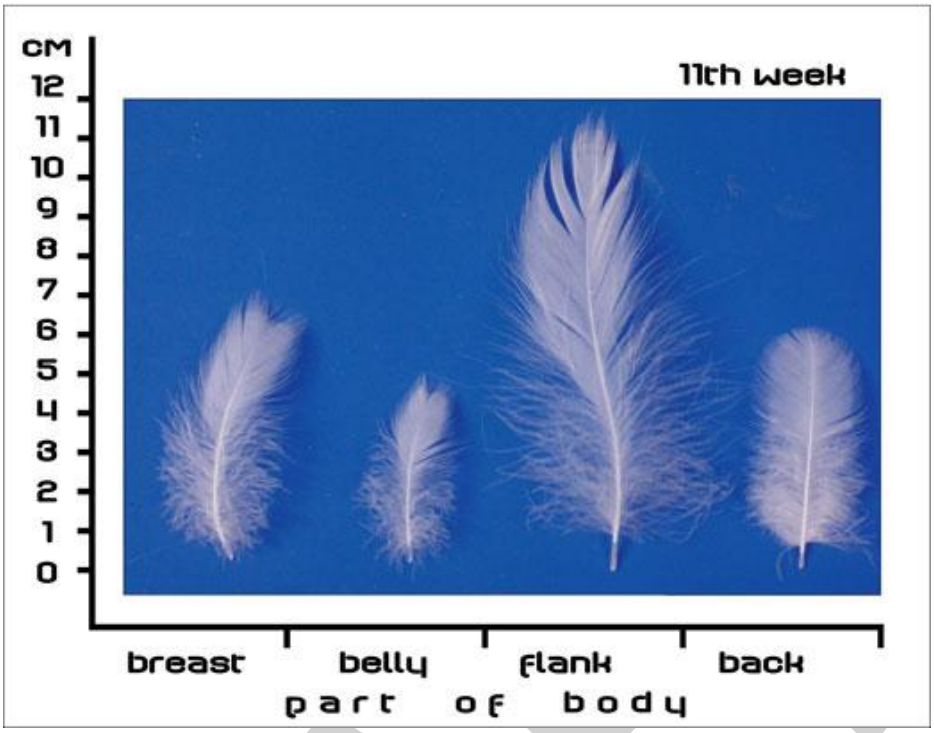


Figure 11: By this time feathers in all four parts attain maturity

Feather growth and development in geese after the first plucking

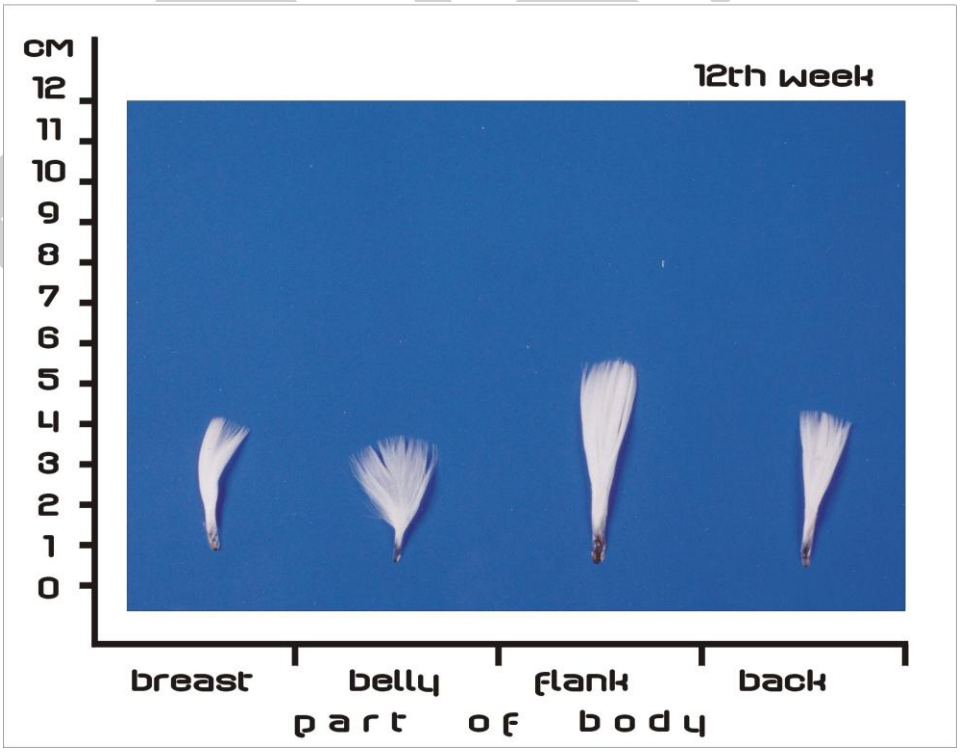


Figure 12: Following the first hand-plucking, pin feathers - enclosed in their horny sheath - are emerging in all body parts

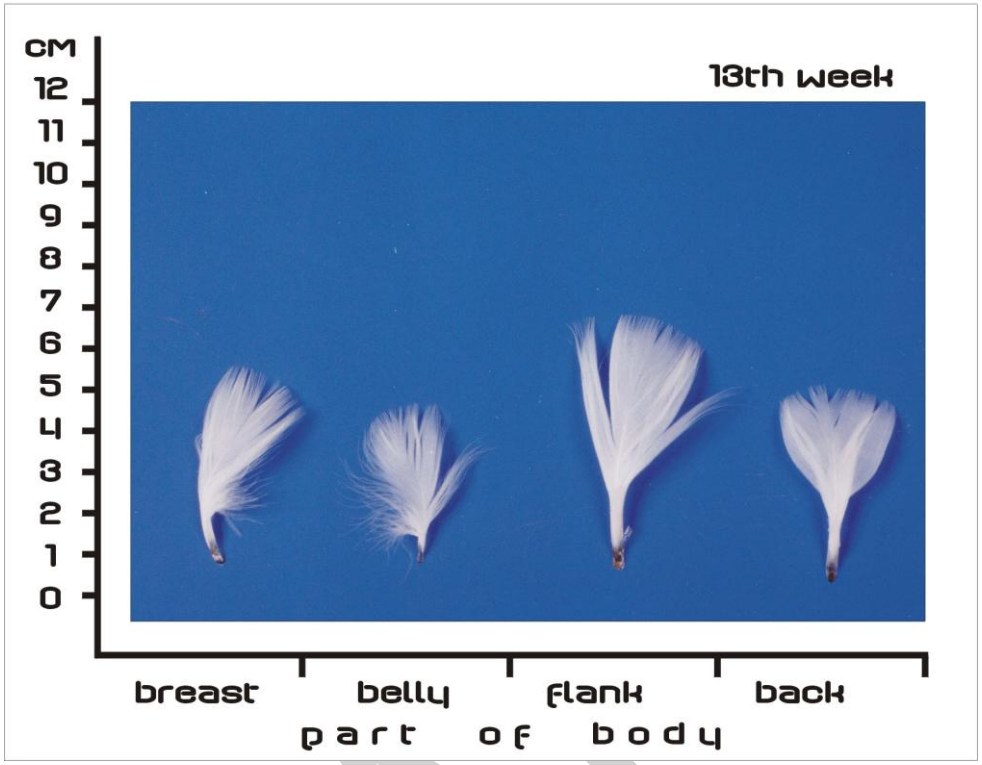


Figure 13: Pin feathers are in intense development

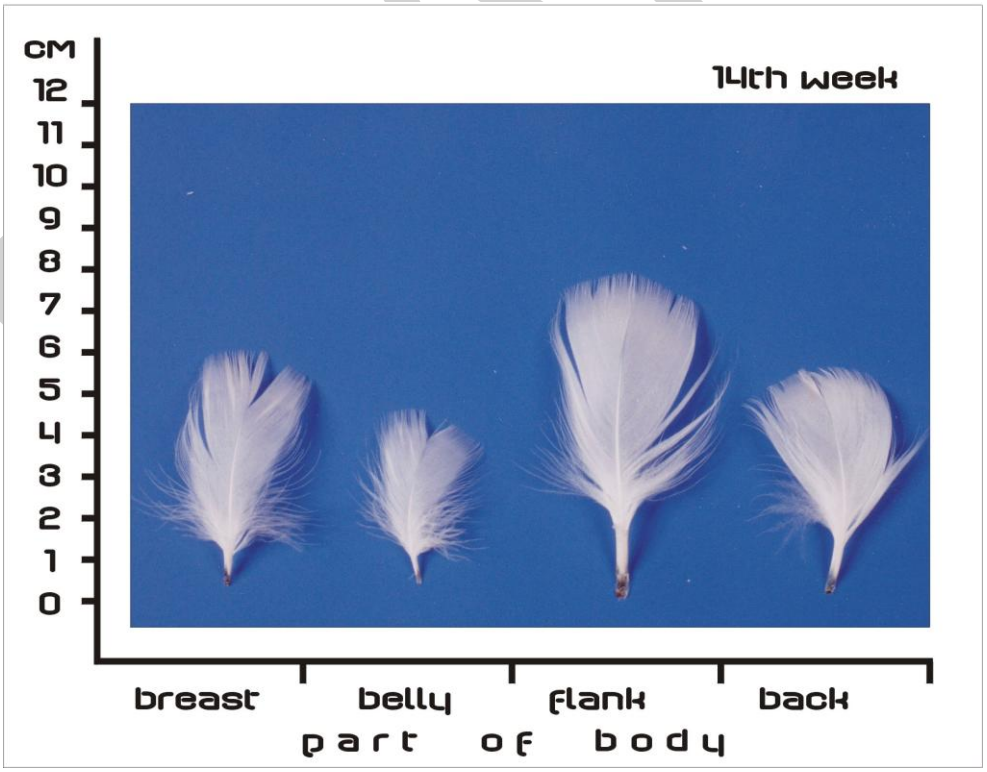


Figure 14: The new feathers continue to develop intensively but still covered by the sheaths

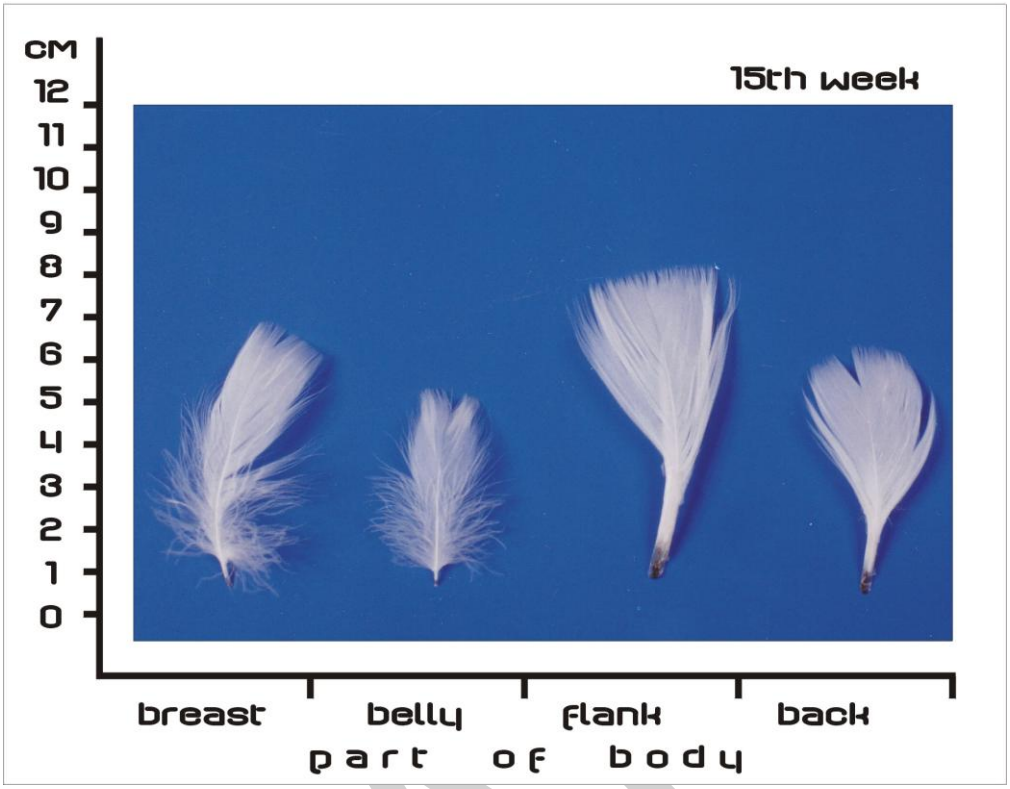


Figure 15: The feathers growing at the flanks and the back are still covered by sheaths

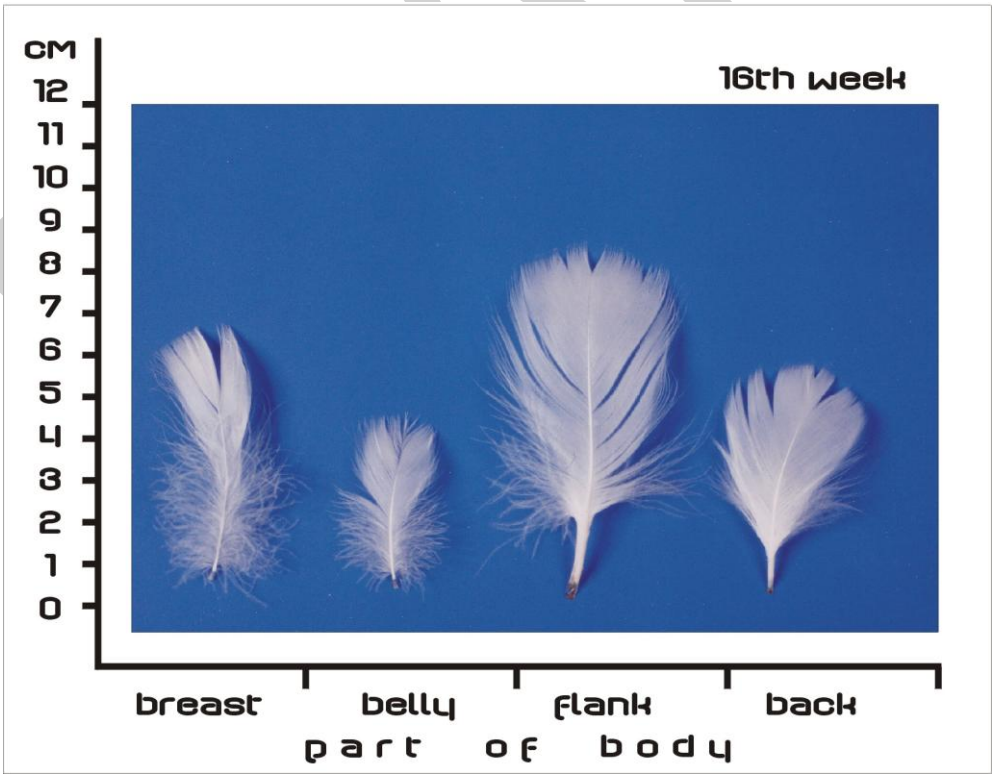


Figure 16: Feathers at the breast and belly have got already in the stage of maturation

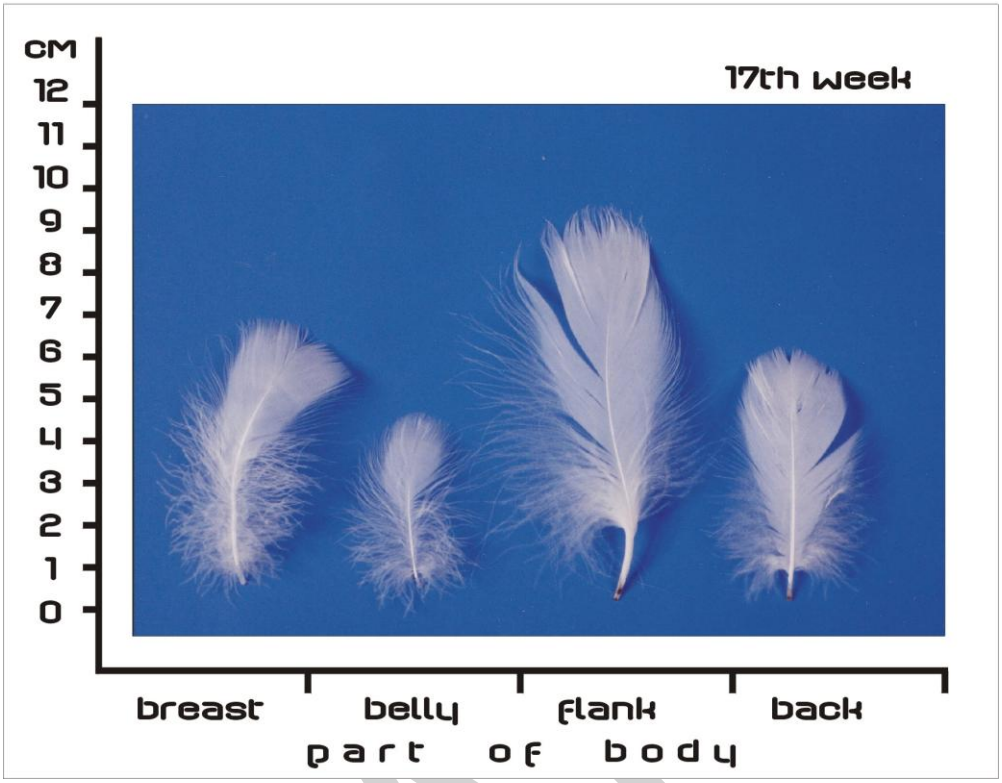


Figure 17: The breast and belly feathers have attained already maturity, but the feathers at the flanks and back are still immature

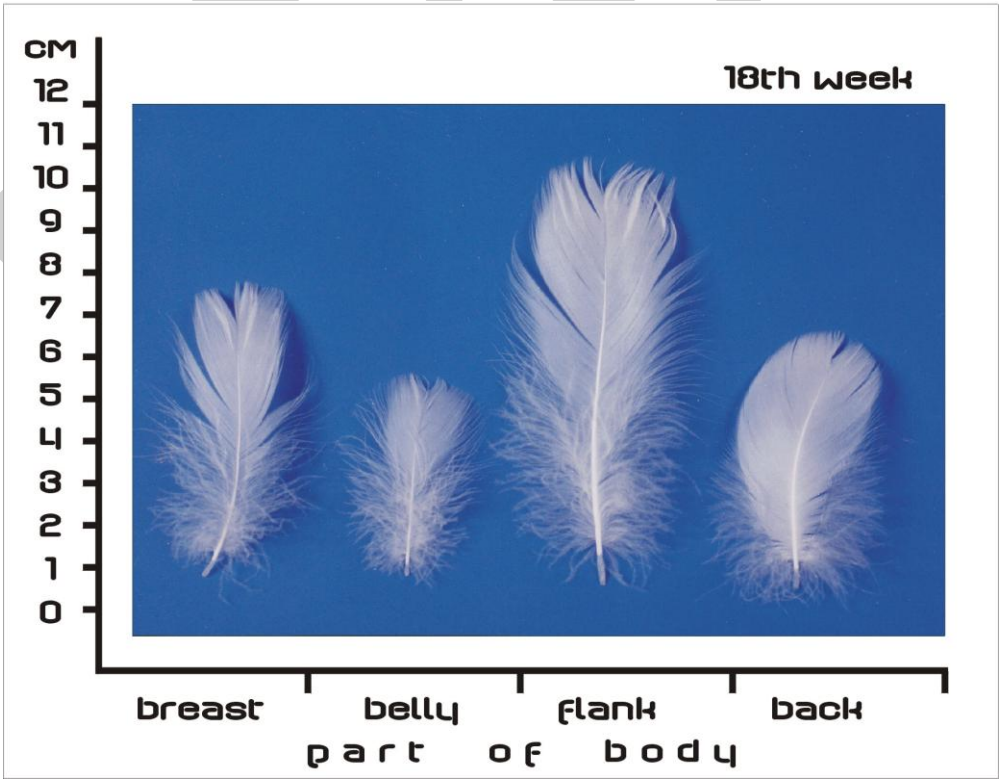


Figure 18: By the end of week 18 feathers have attained maturity in all body parts. It is the right time for performing the second had-plucking

APPENDIX 3 FEATHERS PRODUCTION DATA

Differences in quality between feathers collected from live geese and feathers collected after the slaughter of geese in slaughterhouses (EFSA)

At slaughter feathers and down are exposed to various unfavourable effects degrading the quality traits. In the slaughterhouse birds are bled, dipped in hot water and feathers plucked by a machine. During the slaughter procedure the plumage can be contaminated by blood and excreta (Schneider, 1991). Improper adjustment and operation of the plucking machine may also damage the plumage. Notably, barbs or parts of the vane may get torn away, further the vane may become deformed and contaminated unnecessarily (e.g., when using paraffin wax dipping for plucking) or undergo physical and chemical damage (Ménesi et al., 1964). Recovery of the original properties of feathers and down requires completion of expensive procedures (Schneider, 1991) included washing, rinsing, centrifugation, drying, cooling and sorting (Ádám, 2001). This is the reason for the higher proportion of low quality feathers at slaughterhouse compared to those gathered from live animals (Kozák, 1999a).

Goose feathers and down are of superior quality than feathers from other waterfowls (Ménesi et al., 1964). Of particular value are the fully ripe feathers and down, gathered from well-nourished geese at the moulting time (Ádám, 2001). Only the ripe feathers are gathered from the geese at the moulting time (Schneider), thus feathers with bloody quills hardly occur among them (Schneider, 1995). Broiler geese are usually slaughtered after fattening for 8 weeks of age, when a substantial part of their feathers are still not fully mature. At this time 23% of the plumage is non ripe, 22% is almost ripe and only 55% is completely ripe according to previous data (Zielinska and Baczkowska, 1973, opt. cit. Szado et al., 1991). During manual feather gathering the proportion of non ripe feathers is very small: < 2% (Ménesi et al., 1964). Only feathers and down from the belly, breast, flanks and the back are gathered from the geese while the rest (neck, wing and tail feathers) invaluable for the bed cloth industry are left.

Compared to the first plucking, the quantity of feathers increases on successive second and third gathering in growing geese and adult geese (Bielinski, 1979; opt. cit. Pingel, 1990). Feathers harvested on the second occasion are larger also in size (Kozák et al., 2010b) than those gathered on the first one (Kozák et al., 2010a). Downs harvested from older geese are also larger in size (Szado et al., 1995) thereby weight of their plumage is also higher (Szado, 1972, opt. cit. Szado et al., 1995). The feathers and down harvested by hand are damaged less during the cleaning and washing procedure and thus more valuable and have by circa 40 % higher sales value than those from slaughtered birds (i.e., the industrial product).

According to the European Down and Feather Association (EDFA, 2009), an expert can easily tell apart raw feathers and down collected from live animals from feathers obtained as a by-product of the meat-industry. Once the feathers have been processed it is more difficult to make this distinction as the only difference is in the shape of the base of the feather shaft (more pointed in non-ripe feathers). Feathers removed from dead birds are a mixture of ripe and unripe and are used for different purposes. In IDFL's "Finding the truth about "live-plucking" and "harvesting"" (IDFL, 2009), it is stated that IDFL is investigating, together with other laboratories, possible methods or laboratory tests in order to evaluate if the feathers are obtained through the plucking of live animals.

Szado et. al. (1995), in relation to the production factors influencing feather quality, describes the organoleptic or laboratory tests (humidity, maturity, contents of different types of feathers...) that can be made to evaluate the quality of feathers. Kozák (1999a) establishes that the quality of mechanically plucked feathers is inferior to the quality of hand harvested feathers obtained from live animals, due to the exposition to heat and mechanical effects.

Quantity of feathers harvested from live animals and quantity of feathers collected after the slaughter of geese

Trade in feathers collected after the slaughter and collected from live animals

Intra-EU Trade

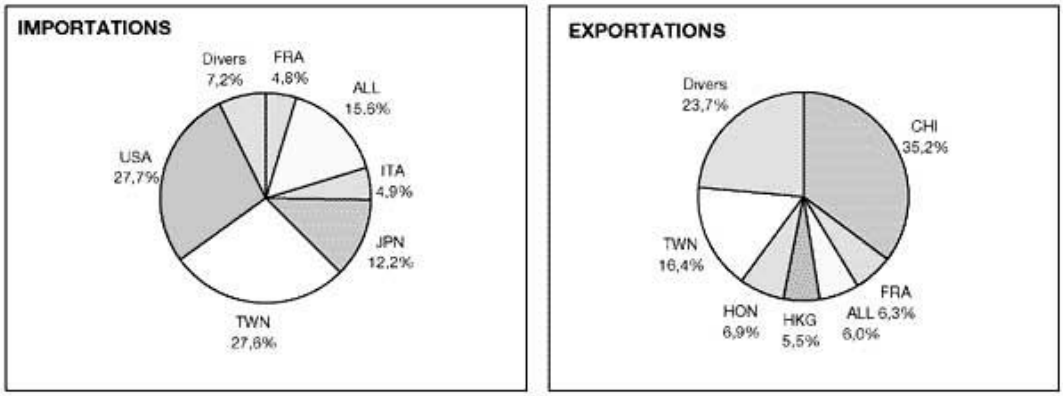
Table 1 indicates the EU trade of feathers. No indication on the species of origin of the feathers and whether the feathers are obtained from live or slaughtered animals is provided.

Table 1. TRACES data on Feather Trade (TRACES, 2009)

FROM	TO	QUANTITY (kg)	Consignments (n)	% Country of origin	% EU trade
GERMANY	NETHERLANDS	10177840.0	504	100.00%	
	Total	10177840.0	504	100.00%	88.00%
HUNGARY	GERMANY	449572.7	46	50.30%	
	POLAND	183669.5	11	20.55%	
	DENMARK	151029.9	15	16.90%	
	ITALY	75931.5	4	8.49%	
	AUSTRIA	21327.3	4	2.39%	
	FRANCE	11680.5	2	1.31%	
	CZECH REP.	611.0	1	0.07%	
	Total	893822.3	83	100 %	7.75%
ITALY	GREECE	149630.0	8	69.59%	
	CZECH REP.	23810.0	1	11.07%	
	SLOVAKIA	23480.0	1	10.92%	
	NETHERLANDS	18100.0	1	8.42%	
	Total	215020.0	11	100.00%	2.11%
LITHUANIA	ITALY	102.0	1	100.00%	
	Total	102.0	1	100.00%	0.001%
ROMANIA	HUNGARY	110180.5	43	43.98%	
	ITALY	74450.6	19	29.72%	
	CZECH REPUBLIC	52795.0	7	21.07%	
	GERMANY	7400.0	4	2.95%	
	AUSTRIA	4800.0	2	1.92%	
	BULGARIA	565.2	3	0.22%	
	POLAND	310.0	3	0.12%	
	Total	250501.3	81		2.17%
TOTAL		11537285.6	680		100.00%

International trade (i.e. FAO data, World Poultry data)

According to data made available by FAO in the FAO Animal Production and Health Paper 154 on Goose production (FAO, 2002), 67000 tons of feathers and down from all waterfowl species were traded in 1994 at an international level, of which about 30% are collected from geese. Over 25 countries (mainly in Europe, Asia and North America) play a role in the feather and down trade, of which six countries import 93% of the world's production.



(Source: Guy, 1996)

In a divulgation article published in World Poultry (2004), professor Pingel states, without identifying the year he is referring to, that 55000 tons of feathers and down of geese and ducks are traded worldwide. The largest producers and exporters are China with 22500 tons, Taiwan with 9000 tons, Thailand and Hungary with 3000 tons each. The main importers are the USA with 19200 tons, Taiwan with 14000 tons, Japan and Germany with almost 8000 tons each.

According to the publication "Hungarian poultry", Feather Production and Feather Processing (1994), Hungary exports 4000 tonnes of feathers annually and is the second largest exporter of feather in the world.

Quantity of produced feathers

The European Down and Feather Association (EDFA) claims that after conducting a survey among its members, it resulted that 98% of the feathers produced worldwide are a poultry-meat by-product obtained at the slaughterhouse. The International Down and Feather Laboratory and Institute (IDFL) estimates that 99% of the worldwide feather production is a by-product of the food-processing industry. This means that about 1%-2% of the world production of feathers and down is obtained by harvesting live geese (IDFL, 2009; EDFA, 2009).

The IDFL (IDFL, 2009) explains that only a very small amount of feathers are harvested in Europe, mainly in east European countries, and in particular in Hungary where less than 10% of the feathers produced are harvested while in the other east European countries, the amount of harvested feathers from live geese is a lot less than 10%. East European countries mainly sell their products to companies for the Japanese market. In Asia, China's production in down and feathers represents 80% of the worldwide supply. Of China's production, only 10% is obtained from geese and less than 0.2% of China's production comes from the harvesting of geese. Most of China's production is exported to Japan.

Quantity of feathers produced by each goose

The quantity of feathers obtained from a single goose can vary according to different parameters as body weight, breed, age, nutrition, management system, etc...

Szado et. al. (1995) establishes that the feathers represent 6,2% of the adult birds' body weight.
The publication "Hungarian down and feather (www.agraria.it) (1997), farming and raw material production", states that during the moult, up to 250-300 g of down feather can be obtained from a well-grown goose each year (Table 2).

In chapter 10 “Feather and Down Production” of the FAO ANIMAL PRODUCTION AND HEALTH PAPER – 154, and as confirmed by Rosinski in the chapter “Goose production in Poland and Eastern Europe-Feather and down production” (FAO, 2002), it is indicated that:

- At 10-11 weeks of age, a goose can provide 60-70g of white soft feathers and down, of which 16% is down.

- Harvesting is then done every 6-7 weeks, at the time of the moult. Birds slaughtered at 17 weeks of age are harvested alive once; birds slaughtered at 24 weeks of age are harvested alive twice. Young breeders are harvested three times. The goose provides 100-120g of soft feathers at the second and third harvesting, with 19-22% of down.

- Adult breeders are harvested three times outside the reproductive season, every six weeks: 70-90g of soft feathers with 15-17% of down at the first harvesting; 110-130g of feathers with 28-32% of down in the next harvesting sessions. A fourth harvesting session could be made giving up to 150g of feathers.

Table 2. Data on feather production (Szado et. al., 1995)

Post-slaughter feathers	*Goose*
Total	*250-300g*
Down in g	*50-60*
Down in %	*20*
Soft feathers without down in g	*125-150*
Soft feathers without down in %	*50*
Hard feathers in g	*75-90*
Hard feathers in %	*30*

It is well known that plumage is light weighted, but despite this, the weight of the plumage of a bird is twice, three times heavier than the weight of their skeleton. The weight of the feathers amounts to 5-7% of the whole body weight (Hoyo et al., 1972). The quantity of feather production and its possible utilisation is determined by the species and by the breed (Table 3). The most valuable is the plumage of the waterfowls, and even among them the best is the goose feather, which is very durable as filler of bed linens, it can last as much as 50 years (Szado et al., 1995).

Table 3. Plumage and its composition in poultry species (According to Deregowski and Jusik, 1973)

Post-slaughter feathers	Goose	Duck	Hen	Turkey
Total, g	250-300	90-120	80-100	190-300
Down, g	50-60	20-25	-	-
%	20	20	-	-
Soft feathers (Without down), g	125-150	50-64	64-80	125-195
%	50	53	80	65
Hard feathers, g	75-90	27-32	16-20	67-105
%	30	30	20	35

Source: Szado et al., 1995.

Body weight significantly influences the quantity of feathers. The quantity of the feather obtained from an adult goose is about 6,2% of its body weight. Within species, from a bigger goose with 4,5 kg

body weight 200-260 g feather can be obtained, while from a goose weights 5-7 kg we can harvest 290-327 g feather (Klosowicz and Kukiella, 1955 and Deregowski and Jusik, 1973, quoted by: Szado et al., 1995). In broiler goose 4,6% of the live weight is the plumage, and in liver goose it is 4% (Ménesi et al., 1965), or in meat-type goose it's rate is 6% (Szigeti, 1987).

After slaughtering 90-220 g usable feather can be obtained from geese (Table 4), and the whole plumage weights 250-300 g (Szado et al., 1995). In liver goose the quantity of the obtainable feather significantly differs according to the breed and the gender (Table 5).

Table 4. The quantity of goose plumage according to the age of slaughtering

Age of slaughtering week	Marketable feather g/goose	From the marketable feather		Down % in the marketable feather
		Covert g/goose	Down g/goose	
9.	90	70	20	22
16.	160	110	50	31
23.	205	140	65	32
30.	220	150	70	32

Source: Schneider, 1995.

Table 5. Obtainable feather quantity from liver goose after slaughtering

Breed	Live weight of the goose, g	Feather	
		Weight, g	% of the live weight
Hungarian Upgraded			
Female	7853	273	3,47
Male	7395	330	4,46
Rhenish			
Female	7747	371	4,71
Male	7932	347	4,36
Grey Landes			
Female	7823	243	3,10
Male	9354	280	298
Dutch goose			
Female	6835	275	4,02
Male	6705	325	4,84
Average weight	7793	306	3,92

Source: Pacs, 1968.

The quantity of feather obtained by manual gathering at one occasion is influenced by the ability of the geese to produce feathers which is genetically determined, by its body size related to its age, by feeding and housing conditions and by the rate of the feather gathering (Tóth et al., 1988) that is, from what body surface and until what degree the feather is removed. The heritability of feather producing ability is relatively low (h^2 = 0,35) (Nagy et al., 1996). The genetic factors influencing the feather producing ability are less known. There can be differences in the feather growth rate between genotypes, genders and individuals. Among the breeds there are fast feather growth ones, as the Czech goose breed for example, in which the first moulting takes part earlier (Bogenfürst, 1992).

The quantity of manually gathered feather from live goose is mainly determined by the size of the body surface. The size of body surface can in practice principally figured according to the body weight of the goose (Tóth et al., 1988). However, studying the feather density on the body surface of different breeds – Hungarian Upgraded, Rhenish, Landes, Dutch and Swan Goose – they have

founded that there are major differences between breeds. At the same time, among the body parts studied (back, rump, breast, belly) in all of the breeds listed above the densest plumage was on the belly. The density of down/fluff is bigger in the in the back and in the belly, than in the other body parts (Pacs, 1968).

There is a strong positive correlation between body weight and the quantity of gatherable feathers from live geese. The correlation coefficient is 0,99 and 0,56 (Gora, 1973; and Szado, 1972 quoted by: Szado et al., 1995), or in the Hungarian Goose breed 0,51 and 0,50, and in the Grey Landes breed 0,26 and 0,31, respectively. However despite the moderate correlation between feather production and body weight with enhancing only the body weight notable quantitative advance in feather production cannot be achieved (Tóth et al., 1988).

Concerning the amount of feather collected from 3 gatherings in the Hungarian upgraded stock, the ganders, either growing or adult, proved to be superior to the female geese (Table 6). This finding is in relation with the difference in body weight of males and females, since larger-bodied ganders have a larger body surface and this fact determines the amount of feathers to be collected. Other determining factors are genetics, keeping conditions and the ratio of gathered and non-gathered body surfaces. Similar tendencies were also found in total down quantity.

In this respect, ganders produced 8-10 g more than layers. Concerning the composition of the feather collected (feather+down), however, the produce of females contained 2-5% more down. The standard deviations and variation coefficients for feather yield, down quantity and down percentage of either sex proved to be very similar in both growing and adult ages.

Table 6. Average yearly feather yield of Hungarian Upgraded growing and breeding geese from three pluckings (Kozak et al., 1995)

Year	Statistical parameter	Ganders				Layers			
		n	Feather + down	Down		n	Feather + down	Down	
			g	G	%		g	g	%
Growing geese									
1990	Mean	42	403.44	118.33	29.33		254.50	112.20	31.60
1991	Mean	157	386.36	113.25	29.31	67	337.68	105.81	31.33
1992	Mean	57	424.68	125.14	29.45	245	370.99	117.20	31.49
(1992)	SD		31.30	14.32	2.40	63	31.95	16.79	2.65
(1992)	CV%		7.37	11.45	8.16		..61	14.32	8.41
Adult (breeding) goose									
1990	Mean	14	380.58			57	357.00		
1991	Mean	121	391.30	129.52	33.09	267	338.80	121.05	37.72
1992	Mean	15	447.63	143.64	32.05	60	365.62	1335.55	37.02
(1992)	SD		58.26	23.91	3.04		46.93	23.46	3.42
(1992)	CV%		13.02	16.65	9.05		12.84	17.30	9.23

Table 7 indicates that individuals (Groups 1 and 2) producing more feather as growing geese produced more feather and down as breeding geese, too, and their progeny carried on these favourable characteristics. Growing geese with a lower feather production (Groups 3 and 4) produced less feather and down as breeding birds, and the same thing applied to their progeny, too. Feather yield and its down content were higher in ganders due o the males' larger body size (Kozák et al., 1995).

Table 7. Feather production of the Hungarian Upgraded geese (Kozak et al., 1995)

Group	Sex	Performance of parents					Performance of progeny		
		n	as growing geese 1993		as breeding geese 1994		N	as growing geese 1994	
			Feather	Down	Feather	Down		Feather	Down
			yield (g)		yield (g)			yield (g)	
1	Gander	1	442.2	133.80	526.2	174.42	5	402.8	111.47
	Layer	4	369.6	127.87	402.6	144.84	4	368.4	109.51
2	Gander	1	404.0	125.37	528.3	162.12	8	399.7	117.74
	Layer	4	342.3	115.05	350.1	108.67	6	335.0	101.63
3	Gander	1	351.6	93.66	415.4	124.39	2	353.9	88.05
	Layer	4	309.6	101.96	351.8	114.03	4	286.5	82.33
4	Gander	1	343.2	110.47	395.7	128.98	4	372.5	99.28
	Layer	4	317.8	96.37	339.1	99.96	7	291.4	96.29

This applied to both growing and adult birds. However, the down percentage of the feather collected was more favourable in the females. Growing geese that were above average in feather production made better producers (more feather with more down) as breeding birds, and transmitted their capability to their progeny (Kozák et al., 1995).

Comparing the feather production – studied in tests and seen in practice – in young and adult geese – the adult geese seem to give more feather, than the young ones (Table 8). This difference could even cause 50 g plus yield in the feather production of the adult, mature geese compared to young ones per year (Pacs, 1968.).

Table 8. Feather production of young and adult geese after manual feather harvesting

Young goose			Adult goose			Source
1.	2.	3.	1.	2.	3.	
Feather harvest (gram)			Feather harvest (gram)			
54	110	122	111	117	119	According to Römer, Szentirmay, 1968
45	87,6	109,9	89,2	73,0	110,0	Bielenski, 1973 quoted by: Pingel, 1993
77,64	134,64	155,10	119,34	102,43	143,79	Kozák, 1999
95	-	-	120	150	-	Pacs, 1968
50-70	90-120	110-150	80-120	110-150	110-150	Schneider, 1995*
-	-	-	110-120	110-120% of the first feather harvesting value		Szentirmay, 1968
80-100	100-130	140-170		-	-	Pálffy, 1980
80-100	140-150	150	100	-	-	Bögre, 1981
80-100	140-150	150-170	-	-	-	Bogenfürst, 1992

Note: *calculated values from cumulated data

Young geese reach 70-80% of the mature body weight by their 7th and 8th weeks of age (Bogenfürst, 1992). At six month of age they are near to their mature live weight (Tóth et al., 1988). These can explain why there is no relevant difference in the feather yield at the 2nd and 3rd feather harvest between the young and adult geese. The growth is feather yield between the first and second feather harvest is not just because young geese gain weight between two feather harvests, but there is a favourable change in the size and in the state of development in coverts and fluffs as well. There is a strong connection between the changes in the body weight and changes in the longitudinal measure of the feathers. After gaining a certain body weight, the growth of the feathers stops in all parts of the

body. “Consequently, the development of the feathers mainly depends on the body weight, and not on the age” (Bögre and Bogenfürst, 1971: 122.p.). This can be the possible explanation of the practical observation that at the 2nd and 3rd feather harvest the feather yield from older geese is approximately equal in no regard to the age of the goose.

Comparing the feathers of young geese from the first and second feather harvest it is found that feathers from the breast, belly, sides of the body and back are longer and more developed at the second time (Kozák, 1999). The feather is less developed, less rich in fluff at the first feather harvest in young geese. Yet at the second occasion quite well developed feather of good quality can be obtained. By the time of the third feather harvest the goose is biologically fully matured, and produces the most valuable feather and fluff (Pálffy, 1980). The plumage from the first feather harvest of the young geese is the so-called gosling feather. This still bears the characteristics of the young, developing animal. The whole plumage is less flexible, the web is rather rare, and the down content of the plumage is 14-18 %. The plumage obtained from the second and third feather harvest is excellent in flexibility and in stuffing/filling force, its down content is at least 25%. The breeding geese give a high fluff content plumage at their first feather harvest – after finishing egg production – its down content can exceed the 30%. (Ménesi et al., 1965), and even can reach the 40 % (Ádám, 2001). On one hand, this is because breeding geese have the most developed fluff; probably since the goose disposed for nesting develops rich fluff in order to keep the eggs warm and the winter plumage of the breeding geese is also (Ménesi et al., 1965). On the other hand, after finishing egg production breeding geese start moulting spontaneously (Bögre, 1981). Therefore in the finishing period of the egg laying a part of coverts are lost, so leaving a relative greater percentage ratio of fluff in the plumage harvested manually.

Studying the weight of the 300 fluffs in young geese, had got the result that compared to the 308 mgs at 14-16 weeks of age, it increased to 349 mgs at 22-24 weeks of age (Szado et al., 1995). So the weight of the fluff increased with 13% during the studied period.

The development of the down depends on the age of the animal, but is also influenced by several other factors, mostly from the feeding and housing circumstances. The weight of one down is significantly less, than the weight of one feather (Ménesi et al., 1965). Investigating the average weight of fluff from the third feather harvest of young geese it had been 0,00136-0,0143 grams (Kozák et al., 1999). A down is considered to be more valuable if it has more down fibre and these down fibres are longer. The number of down fibres usually varies between 70 and 100 (Ménesi et al., 1965). Studying the plumage of young geese from the third feather harvest resulted that the bigger down diameter is related to the more numerous down fibre. There is a positive correlation between the number of down fibres and the weight of the down: in females r = 0,7, in males r = 0,4 (Kozák et al., 1999).