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Automatic Feed Supply in Horse Keeping Systems

Horses are adapted to a scanty feed supply through their original steppe habitat. Their behaviour, as well as their digestive tract, reflect this: horses graze from 10 to 12 hours daily, with only short pauses in between. The structure and size of their gastro-intestinal system is designed for the continual intake of small portions. Horse-adapted feeding therefore should have many small roughage and concentrate rations throughout the day, i.e. more than three feedings per day. In practice this can be achieved through automation technology for the feed supply.

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Literature

Literature references can be called up under LT 04311 via internet http://www.landwirtschaftsver-lag.com/landtech/local/literatur.htm.

The feed supply of forage and concentrates is done manually in most horse keeping farms. With this type of feeding, watching the animals directly, supplying supplementary feed and - if necessary - medicine is possible without problems.

Feeding Processes in Practice

Due to the labour requirements, horses are generally fed larger portions of feed twice a day. This twice-a-day feeding leads to extreme excitement, significant stress and related behaviour problems. To prevent this, concentrate is often provided first, although from a nutritional physiological perspective the forage should be presented first.

Combined with a lack of adequate exercise, the twice daily feeding of larger amounts of highly concentrated feed is one of the main causes of serious metabolism problems and colic in horses [6]. Forage is generally offered ad libitum (i.e., in round troughs) which can lead to weight problems of horses with large appetites and minimal exercise. The provision of concentrate from a feeding station permits individually tailored animal care only with additional labour input (i.e., tethering the horse) to prevent the crowding out of horses lower in the animal hierarchy.

Advantages of automatic feeding

The provision of feed via semi- or fully-automatic feed automates has serious advantages for both humans and animals.

The advantages for the owner rest mostly in the more flexible management of labour time as well as in the lower labour intensity. Depending on which type and controlling program the automate has, different basic rations and concentrates can be offered all day long to the individual animals.

Advantages for the rider are freedom from particular feeding times. Due to the distribution of the rations in many small portions, the horse's stomach and intestinal tract are never overly full so that no resting periods are required prior to and following feeding. The contentment of the horses is evident in their very calm behaviour.

Fig. 1: Rolling feed rack with a simple animal identification for combined roughage and concentrate supply

The advantage for the horse is the free access to small amounts of basic rations and concentrates offered throughout the day, meaning that metabolism problems and colic can be avoided. Together with open stall husbandry, with an appropriate spatial division of the functional area, additional exercise can be offered and the conditioning of the horse can be increased [4].

FAL developments for automatic feeding of basic rations and concentrates

Rolling supply racks
The rolling supply rack was developed in the mid 1980s in the former FAL Institute for Agricultural Building Research to provide basic rations in a multi-room loose housing stable. The rolling rack makes ad libitum feeding of basic rations possible. In a further development, an over- feeding of horses with large appetites shall be prevented. An additional gate of vertical bars was integrated into the rack (*Fig. 1*). The distance between the bars was freely adjustable. A reduction of the distance between the bars reduced the amount of feed consumed. A similar effect can be achieved with a narrow hay net.

Supply rack for individual provision of basic rations and concentrates
The goal of this development was to realise the individual provision of basic and concentrate feed in group husbandry throughout the day.

For this purpose each animal was assigned a special feeding spot. Only with identification (an electro-magnetic induction switch) a horse is able to enter the feeding area [2]. The feeding area is barred with a vertical wooden door, which can only be opened by the assigned animal and which is drawn back up after feeding with a counter weight. Individual dosage equipment is used to offer concentrates.

Fig. 2: Rolling feed rack with timing controlled curtain

Rolling supply rack with curtain

A curtain was integrated in the first development stage to limit the duration of entry to the rolling rack. The curtain can be rolled up or down electrically (*Fig. 3*). The mealtimes are distributed throughout the day via a timer while a time relay determines the duration of feeding. The dividers between the feeding slots are fastened directly onto the rolling rack.

Testing stable

The institute's current horse keeping testing stable is divided into an area with individual boxes and group husbandry, both systems are combined with permanent access to paddocks.

The provision of concentrates is made with a concentrate single dose equipment (Fa. Weinsberger) in single box keeping. The automates are all turned on at the same time so that no great unrest occurs at mealtimes. The hay rationing is achieved with a Hay Dosage Machine (Company HIT / Wasserbauer). Based on our suggestions, the hay dosage unit was integrated into the sliding doors of the single boxes so that no space was lost in the boxes (*Fig. 2*). A process computer made up to ten feeding periods possible in 24 hours.

In group husbandry, the natural behaviour of the horses is respected since horse prefer to eat as a herd. For this reason a prototype was created in which the combined provision of basic rations and concentrates is possible within one feeding area, as it is already the case with the "Völkenrode rolling rack". The identification technology uses a transponder on a collar. The combined responder station makes a distribution of the total ration possible in 20 portions throughout the day. The software makes many various combinations of basic rations and concentrate dosages possible. With an animal-feeding slot ration of one to one the assignment of a feeding slot to

a particular horse and thus a supply appropriate for an individual animal is not a problem. The effects of a reduction of feeding slots on the behaviour of the horses is currently being studied within the framework of a dissertation.

Other products on the market

Concentrate feeding automats or dosage equipment can be used both in single boxes as well as in group husbandry in combination with feeding slots. A further automation stage is presented with the filling of the concentrate dosage unit via a conveyor system. Only with a identification system is the provision of appropriate levels of concentrates possible for individual animals.

The concentrate rail wagon (*Fig. 4*) is used primarily in single box keeping, where it is transported up to ten times a day from box to box and distributes concentrates. The modular design allows an expansion to up to nine types of feed including a liquid feed additive. In dairy cow husbandry, as well as in larger breeding sow herds, concentrate feed responder stations with electronic individual animal identification have proven themselves for many years. This principle is also used in large group keeping of horses. In the concentrate responder stations up to nine feedstuffs can be offered individually to each horse. Transponders or injectates serve to identify the animals. The station can serve between 25 and 30 horses. Mobile concentrate stations for the pasture have also become available.

The forage room [1] can be an old stable or a fenced off area with an entrance and exit. The horses enter via a computer controlled entrance door. This solution offers the possibility to allow difficult to feed horses ad libitum access to forage and horses which eat too much to be fed outside of the area.

The feed block (Fa. Schauer - [1]) can be used in both individual husbandry as well as in group husbandry. A time control is used to offer concentrates and/or forage as often and

Fig. 3: Hay pusher device, integrated in the entrance to the individual box

as long as desired. In group husbandry the already described identification and control technology is used for individual feed distribution.

The Langemeyer Company is currently testing its own development in distribution technology for concentrates. In contrast to other dosage technologies, air pressure is used here to propel the feed, meaning that complicated machinery is not necessary. In contrast to other commercially available construction solutions, the trough in the concentrate feeding station will only be opened from the wall with a pneumatic cylinder if the horse is entitled to feed.

Summary

Automated feeding is making progress in horse keeping because it has significant advantages over manual feeding. From a digestive physiological perspective, an optimal feeding adapted to the natural needs of the horse is made possible. Computer controlled feeding systems provide a free organisation of the work processes and significantly reduce the labour requiremenrt. The use of innovative housing practices, such as group husbandry in free movement stables, is being increasingly accepted through the use of modern feed supply technology and flexible floor plan solutions.

Fig. 4: Feed rail container for concentrate supply in individual keeping (photo by company HIT)