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Automatic Feeding Stations for Horses

In recent years, the number of horses kept has increased to round about 900,000. At the same time, more and more animals are being kept in loose houses and groups, even though greater management demands are placed on the animal keeper. In order to provide optimal and animal-friendly feeding conditions for this kind of husbandry, automatic feeding stations were developed, which can dispense feed several times throughout the entire day. This makes it possible for the individual demands of the animals to be accommodated, while minimising the dangers of overfeeding or of low-ranking animals being driven away during feed intake.

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Keywords

Horse keeping, individual feeding system, process controller

The group husbandry of horses in loose houses comes very close to the natural demands of the animals for social integration and exercise and supports these activities. Especially the number of diseases affecting the breathing- and digestive system as well as behavioural disorders, such as wind sucking and weaving, declines. Feed dispensing, however, proves to be problematic, because under natural conditions the animals spend up to 16 hours eating. For this reason, feed should be dispensed several times a day and enough time should be available for every animal to take in a sufficient quantity of feed in peace. On the other hand, there are some animals which do not exercise enough in the loose house so that they tend to be overweight and are in danger of being overfed. Therefore, the necessity of individual feeding arises, which also enables low-ranking animals to eat without being disturbed [1]. In order to keep the work requirements low, feed dispensing should be automated, wherever possible.

For official identification (horse pass), microchips, e.g. in the form of injectable transponders, are widely used. Hence, the possibility of using this electronic identification for automatic feed dispensing suggests itself.

For group loose housing, feeding stations where the animals take in the feed from a feed table next to each other, though separated by partitions, have proven themselves. Based on these findings, an access control system with an electrically driven barrier which closes the feed table off was developed ten years ago at the Institute of Agricultural Engineering Weihenstephan [2].

Goals

Due to the positive practical experience with electronically controlled access gates on several farms, the Weihenstephan system was intended to be improved with regard to reliability as well as animal- and environmental protection (noise) and made available as a universally usable construction kit for stable equippers.

From the viewpoint of nutritional physiology, it is necessary to meet the demand of horses for forage (roughage or basal feed) and feed concentrate. The design of the automatic feeding station should be simple, robust, and as similar as possible for both kinds of feed. At the same time, it was intended to clarify, whether an automatic feed concentrate dispenser in the form of a one-way feeding station with special protection for the eating horse (sophistically designed entrance and a separate lateral exit), which was also developed by the Institute of Agricultural Engineering Weihenstephan [2] can be replaced by the simpler solution.

Design and functional principle of the universal feeding stations

The basis of individual feed dispensing is electronic animal identification with the aid of RFID transponders, the control of access to the feed, and the precise registration of the time the animals spend in the feeding station.

In principle, the feeding stations consist of a vertical sliding gate with a control- and drive unit. The feed tables with the supply of roughage or silage or a feed concentrate dispenser are situated behind this access gate (*Fig. 1*). According to the requirements of a construction plan, the partitions of the feeding station can be built by the horse keeper so that the antennas for animal identification are integrated into the partitions. The access gates are moved by electric motors on cable winches along guide bars, which guarantees safe motion. During commissioning or after a power failure, the gate is moved through its entire opening range, and the upper and lower final position is determined. During installation, this allows for adaptation to different fitting dimensions, and partial closing of the gate is prevented. Since the transponder may be outside the range of the reading antenna during the eating process, a photo sensor oriented towards the withers of the horse is used to determine whether the animal is still in the eating position (*Fig. 2*).

The time which the animals spend in the opened feeding station and the previously defined individual eating speed allow roughage consumption to be calculated with suffi-

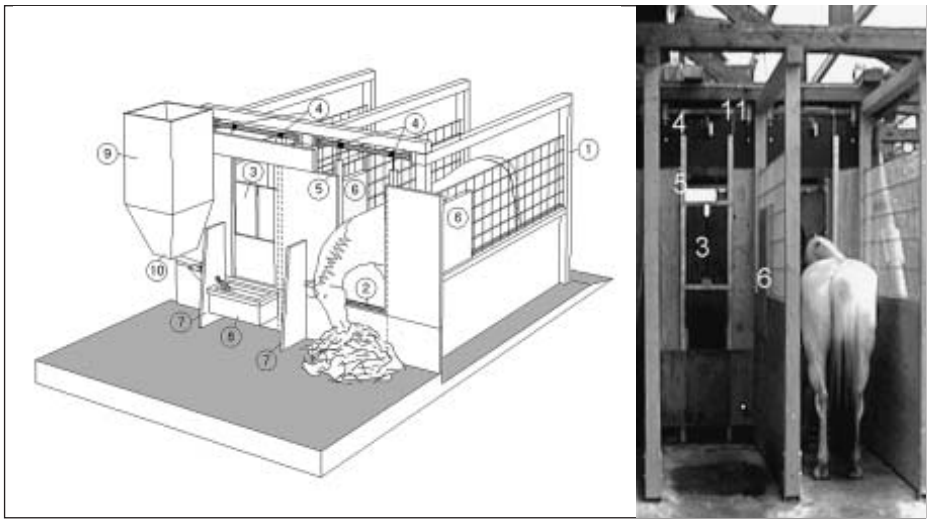

Fig. 1: Design of the feeding station (1 station partition, 2 access gate down/open, 3 access gate up/ closed, 4 cable winch for access gate, 5 guide bar for access gate, 6 antenna, 7 feeding place partition, 8 feed trough, 9 concentrate feed container, 10 concentrate feed dispenser, 11 photo sensor)

cient precision. Feed concentrate is dispensed in feeding stations featuring an analogue design. Small, volume-metered partial portions fed into a feeding bowl enable the feed concentrate to be precisely dispensed. All visit data are accurately recorded and can be used to refine the feeding regime.

All control tasks are realised by a reliable efficient process computer in each feeding station. In the process computer, the animal data, such as the transponder number, feed entitlement and -status, eating speed, and general station data, such as eating times and drive parameters for gate control, are stored. The process computers are interconnected via a BUS and can thus exchange all current feed consumption data, which allows an animal to be exactly fed at several feeding stations. This BUS also provides a connection to the PC, which is exclusively used for the adjustment of the station- and animal data as well as the long-term registration of eating behaviour and its evaluation. For this purpose, Windows software has been developed, which in the control mode supports the service expert during the adjustment of the stations while facilitating animal management and the evaluation of eating behaviour in the user mode. The PC does not need to run continuously, because all control tasks are performed by the process computers.

Practical results

Whereas up to ten single rations per animal were scheduled in the pilot plants, practical results have shown that four freely adjustable feeding time intervals per feeding station are sufficient for feed dispensing and that the remaining breaks provide the animals with additional opportunities to move around. The feeding times for the feed concentrate can be scheduled after roughage dispensing. The feed concentrate offered in intervals is consumed relatively quickly by the animals. If the animals are no longer entitled to take concentrate in during a particular feeding interval, the horses quickly loose interest in the feed concentrate station, move on to a roughage station, and let low-ranking animals, which are still entitled to feed, access the feeding station. An appropriate animal-/ feeding place ratio is important for this system to work. The minimum equipment required for agisted horses includes a feed concentrate station and two roughage stations for a maximum of six animals. The spatial arrangement of the stations allows the functional area "eating" to be disentangled. If a sufficient number of feeding stations are available, it is always possible for low-ranking animals to leave a high-ranking animal's area of influence and to take in feed in peace. The PC program allows the feed intake and the eating behaviour of each single horse to be monitored also in comparison with the entire herd. This guarantees appropriate feeding adapted to the needs of the animals.

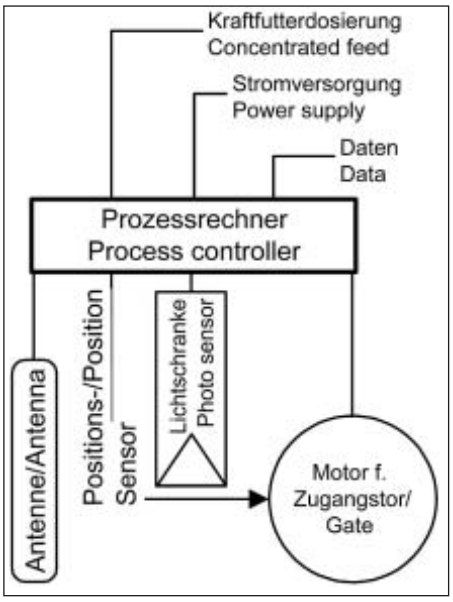

Fig. 2: Block diagramm of the feeding stations

Conclusions

Feeding stations accessible from behind allow the automated feeding of individual animals to be realised at low expense, if the requirements of herd management and the constructional solution are taken into account at the same time. The distribution of feed dispensing over four freely programmable feeding intervals per feeding station enables feed intake to proceed in a controlled order, reduces food rivalry, and stimulates the animals to move about. Only in the case of difficult rank problems, large feed concentrate quantities, and a desired spatial disentanglement of the feeding area does the use of a sophisticated automatic feed concentrate dispenser designed as a one-way station provide the better solution.

Literature

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