

Utilisation of waste heat from biogas plants for drying fine-grained legumes

Problem

The combustion of biogas to generate electricity generates a lot of waste heat, which is often not sufficiently used. Fine-grained legumes, such as lucerne or clover, are important in the crop rotation on organic farms. At the same time, they are a good source of proteins, amino acids and roughage in feed.

Outdoor-dried hay from fine-grained legumes is a risky business due to the weather. Field drying can lead to very high leaf losses, which greatly reduces the protein and amino acid content. This is why fine-grained legumes are mown early (see Fig. 1), brought in moist (see Fig. 2) and then dried on the farm in an energy-intensive way.

Solution

The approach here is to use the waste heat from biogas combustion for the drying of fine-grained legumes. There are different methods for drying the crop. They all use the warm exhaust air, which is sucked in by a fan and fed to the various processes via air ducts.

Loose plants can be dried with a continuous dryer or in special drying containers with perforated floors (see Fig. 3). For better and more compact storage, the crop should then be compressed into bales (see Fig. 4).

Another option is to press the crop directly in the field, and the bales are then ventilated directly (see Fig. 6). However, the residual moisture in the field must be reduced to a maximum of 20%. The costs for the drying are 8 to 10 € per bale.

Applicability box

Theme

Processing and handling of harvested feed

Context

Use of biogas waste heat to achieve a high concentration of ingredients in fine-grained legumes.

Application time

During the vegetation period for hay, in autumn for maize and cereals.

Required time

10 to 20 hours for the crop to pass through the system; the net drying time is 3-6 hours.

mowing and recovery time depends on the degree of used technology.

Period of impact

Permanent

Equipment

Harvesting machines for grassland, continuous dryer, bale drying blower, baling press

Best in

mostly used for ruminant feeding, but can now also be used for monogastric feeding due to higher nutrient concentrations



Figure 1: Mowing of fine-grained legumes. Photo: Qualitätstrocknung Nordbayern (<https://qtn.de/luzernecobs>)



Figure 2: Fine-grained legumes are brought in moist. Photo: Qualitätstrocknung Nordbayern (<https://qtn.de/luzernecobs>)

Benefits

- Low loss of leaf mass leads to high concentration of protein and amino acids.
- A fast harvest reduces the dependence on the weather.
- Waste heat utilisation of the biogas plant and a possibility for the operator to earn additional income through contract drying.
- Extension of the range of applications for fine-grained legumes in monogastric feed from roughage supplier to protein supplier

Practical recommendation

Continuous dryer

- The legumes must be mown early. Then they are chopped with knives in the loader wagon (length 3.5 cm).
- As a rule, it is left to dry in the field for one day before being loaded onto wagons. Depending on the weather, two days are also possible to reduce moisture content from 50% to 33%.
- A large loader wagon (see Fig. 2) is always delivered full, which corresponds to one hectare depending on the yield.
- The drying temperature for clover is 79°C on average. The hay runs through the system in 10 to 20 hours, depending on the humidity. The actual residence time in the dryer is 3 to 6 hours.
- The dried clover is baled under high pressure into large square bales weighing around 300 kg (see Fig. 4).
- Instead of using a bale press, the dried hay can be pelleted.

Bale drying

- The fine-grained legumes are mown at the beginning of flowering.
- As long as the crop is still green, it is turned twice on the field.
- In the evening, the hay is rowed. At noon of the following day, the crop is rowed for baling.
- In the afternoon, it is baled. Residual moisture should be between 16-20% and no higher than 22%
- The bales are dried at 40°C for 20 to 24 hours. They must be turned once.

Recommendations for both procedures:

- The dried bales can now be stored and fed directly
- For feeding monogastric animals, the dried legumes should be ground in a mobile grinding and mixing plant (see Fig. 5) and mixed homogeneously into the ration.



Figure 3: Special drying containers with perforated floors Photo: Werner Vogt-Kaute



Figure 4: The crop is compressed into bales. Photo: Werner Vogt-Kaute



Figure 5: Mobile grinding and mixing plant. Photo: Christopher Lindner



Figure 6: Ventilation of bales. Photo: Anton Elsasser

Further information

Video

- Take a look at the [video about the Alvan Blanch conveyor drier.](#)

Weblinks

- Check the [Organic Farm Knowledge](#) platform for more practical recommendations.
- Alvan Blanch: [Multi-Purpose drying ovens](#) (in German)

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