Large Square Baled Silage Storage & Mould Problems

Frank Mickan
Fodder and Pasture Specialist
DEPI, Ellinbank Centre

Large square (actually rectangular) bales of silage can be stored above ground in small compartments, in ground in slightly larger compartments or can be wrapped in stretch-wrap plastic either individually or in continuously in-line.

Storing large square bales of silage under sheets of plastic should be cheaper than being individually or continuously in-line wrapped. If the stack remains airtight this can be the case. However, in many situations, this is often not the case because many bales are mouldy when the stack is opened!

Mouldy silage (Figure 1) usually occurs due to the presence of air in the stack at some stage. Mouldy silage represents a loss in dry matter and silage quality and results in increased cost per unit weight or energy. The amount of loss will depend on the extent of mould growth and aerobic deterioration of the bales. The moulds, aerobic bacteria, yeasts, etc. which set up camp and multiply profusely in these ideal conditions, actually "feed" on what you were try to preserve for your animals, the energy and proteins.

Figure 1. Mouldy large square bale of silage

Under these "aerobic" conditions the silage breaks down into carbon dioxide, moisture and heat, eventually becoming compost. The bales will begin to heat with the result that, the hotter the bales, the higher the proportion of dry matter and nutritive value being lost.

Mould Problems

Following are some possible causes of the different degrees of mould growth in large square baled silage storage systems:-

1. **Small areas of mould on the bale exterior after several months of storage.**
   The plastic sheet may have a slow leak due to a small hole or air is entering the stack at the bale-ground juncture, or the folded ends are not airtight.

2. **Large areas of mould on the bale exterior after several months of storage. Moisture build-up on the underside of plastic sheet.**
   Large or many small holes in the plastic sheet is allowing a lot of air to enter, or the seal at ground level is not totally airtight, or the folded end flaps are not very airtight.

3. **Large areas of mould on bale exterior and "growing" inwards towards the bale centre and bales may be warming. Moisture build-up on the underside of plastic sheet and on bale exteriors.**
   Very large or many small to medium sized holes in plastic sheet or very poor seal at base of stack or folded ends ineffective. If the bales are tight then the air has been entering for quite some time.

4. **Large areas of mould on bale exterior, mould throughout most bale interiors, bales will be very warm to hot! Excess moisture build-up on the underside of plastic sheet and on bale exteriors.**
   Very large or many holes in plastic sheet or very poor seal at base of stack or folded ends ineffective and/or the air has been entering for a long time. Bales may have been baled relatively "loosely" (for large squares) or the crop may have been too mature, ie stemmy, at baling.

5. **Any of the above with effluent flowing out of stack bottom.**
   This effluent could be from silage made too wet, or as a result of the silage substantially deteriorating from air entering the stack. Aerobic deterioration leads to the ensiled forage "breaking down" and producing carbon dioxide, heat and water.

NOTE: Try to avoid breathing in "air" from under these mould affected stacks as the carbon dioxide levels may be very high and the "air" may contain mould spores. Uncover a small proportion of the stack and allow some time for the "dangerous" air to escape.

Storage Systems

1. Above ground stacks (modules/compartments)

For stacks above ground, build small stacks each holding about 14 – 16 days feed in each compartment (See Figures 2a & b). If the plastic is billowing in windy conditions, too much air is probably entering somewhere! Placing tyres or soil on top of each stack will minimise the flapping, If not the plastic will eventually crack, allowing air entry.

Using dirt to seal at the bale-ground interface can ensure an excellent airtight seal. Dig a trench before or after the stack is built. Place the plastic sheet into the trench, folded so that the edge sticks back up out of the ground trench. Dirt is then placed into this trench against the plastic. The jutting plastic sheet edge is then easily pulled up when unsealing the stack. See diagram 2.

An alternative is to lay the sheet edge on the ground and cover it with dirt, ensuring the film edge is covered.

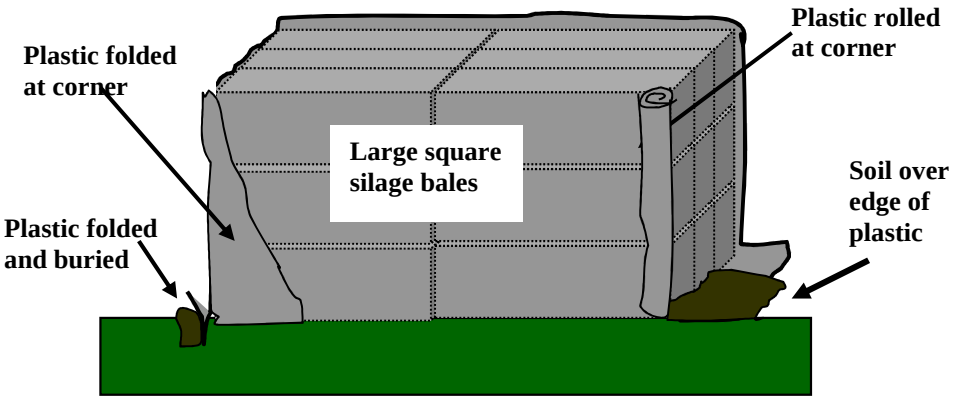

Figure 2a. Well sealed stack showing ground sealing techniques

Figure 2b. Well sealed stack showing ground sealing techniques

2. In-ground stacks

If stacking large square bales into pits in the ground (Figures 3a & b), place the bales hard against the back of the pit and along one side. This then leaves only the front and opposite side of the stack to "expel" the air when sealing. The side "gap" can be either filled with soil to expel the air or, preferably a plastic sheet dropped down to the ground and then soil forced in between the plastic and the wall to expel the air. The top sheet must overlap the "gap" to prevent rain entering and seeping down to the stack base.

Use plastic sheets to seal stacks into compartments containing 18 - 20 days feed. This is suggested because if the top of the sheet is holed by cattle, rabbits, dogs, kids, etc. then only the holed compartment will "go off", provided the seal between compartments is effective. Similarly, when feeding out starts and the stack is opened, the air is confined to the current compartment. Putting dirt around the edges of the stack and or down the pit sides will help to form a good seal. Figure 3 shows recommended sealing of large square bales in pits.

If plastic is holed, immediately repair it by using plastic tape specifically made for silage film. Grey duct tape is not suitable. Ensure the plastic is dry, clean and cool before applying plastic to holes. Cut tape to length, let it shrink back, then apply it.

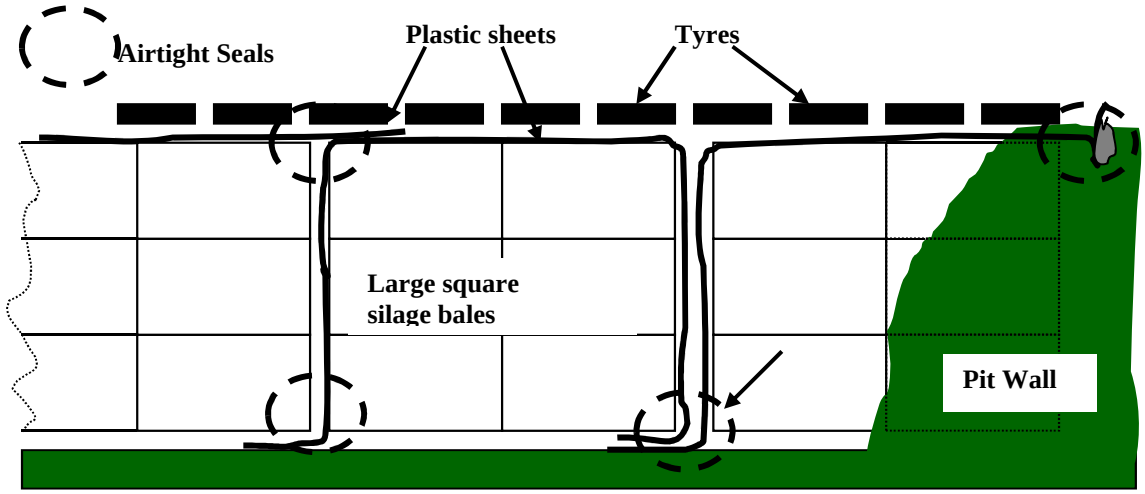

Figure 3a. Large square bales in well sealed compartments in pit.

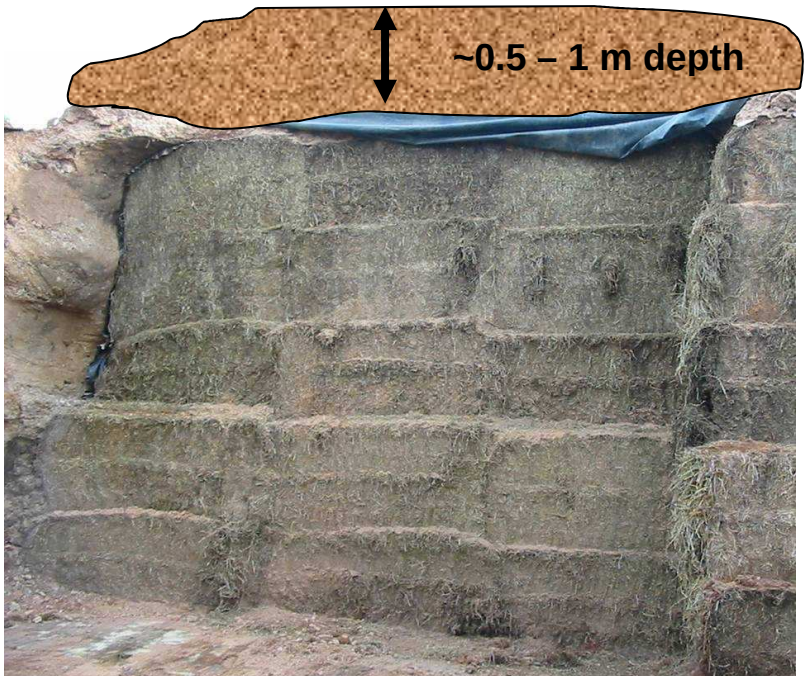

Figure 3b. Large square bales in well sealed compartments in pit.

3. Stretch-wrapped bales

Large squares bales can be wrapped individually in stretch-wrap plastic. The entire bale must be covered with at least four layers of plastic and with no underlapping! Losses will be minimal provided the plastic is not holed and the bales are fed out within about twelve months. They may last another year if wrapped in six layers.

Large squares can also be wrapped continuously in-line by using a tube wrapping machine (Figure 4) but the bales must also have four layers over the entire bale circumferences. These machines do save about 30 – 40% plastic compared to individually wrapped bales because the bale ends are not wrapped Bales of even diameter are necessary to avoid over stretching of the plastic at the bale juncture of large vs small diameter bales. Over stretching often leads to the plastic ripping and allows air entry and soon after, aerobic deterioration! To avoid this most manufacturers these days suggest applying 6 layers minimum bales wrapped with continuous In-line wrappers.

Figure 4. Large square bales continuous-in line wrapped

Drought Storage

Large squares are suited to underground/pit storage provided the stack is sealed airtight and watertight. They should be compartmentalised into 3 – 4 weeks feed with plastic so that air cannot penetrate too far back into the stack when feeding out. To give an Diagram 3shows an excellent seal for long term drought storage having a layer of 0.5 – 1 m soil on top instead of the tyres. Plastic is needed at the interface between the soil and silage to prevent water from gaining entry as might occur if foxes/rabbits, etc. dig a hole half way through the dirt layer.

Silage Additives

Using an aerobic spoilage inhibitor in modules, in-ground stacks and for drought storage is recommended to delay spoilage at opening. This will delay heating and mould growth for several days after opening but won't be effective for long exposure to air via holes nor where air can move down the sides/top of the stack.

Traditional silage fermentation enhancing additives, of which inoculants are the majority but not exclusively, will improve fermentation and usually results in slightly less dry matter and quality losses during fermentation and is particularly useful where the silage is slightly below or above the target dry matter content for the silage form.

Both silage additive types are applied at harvest preferably at the throat/pick-up of the baler or harvester. Applying inoculants onto the windrow ahead of the pick-up is very ineffective (not enough forage comes into contact with the bacteria), if applied too far ahead they may dry and die and dangerous for the person applying the product.