

AGROPACK
ROTARY HAY-COMPACTING PROCESS

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Considering the present state of hay-packaging technology, the AGROPACK rolling-compressing process represents the only commercially available compacting method which can be applied to practically all varieties of hay crops, to produce high-density and self-contained small packages, at the moisture contents range from about 20 to 50 per cent.

This relatively new process was developed to fill an existing gap, and to open new avenues, leading to efficient haying operation, producing high quality feed material. The crop, (alfalfa, grass, or residue crops) can be compressed at an earlier stage of field curing, converting it into a product which is readily adaptable to bulk handling, not requiring any binding material, and providing favourable conditions for efficient drying, or for other methods of stabilizing the crop for safe storage.

The following chart illustrates the operating ranges for the various hay-packaging methods, in relationship to moisture-contents and to the approximate number of days after cutting the crop.

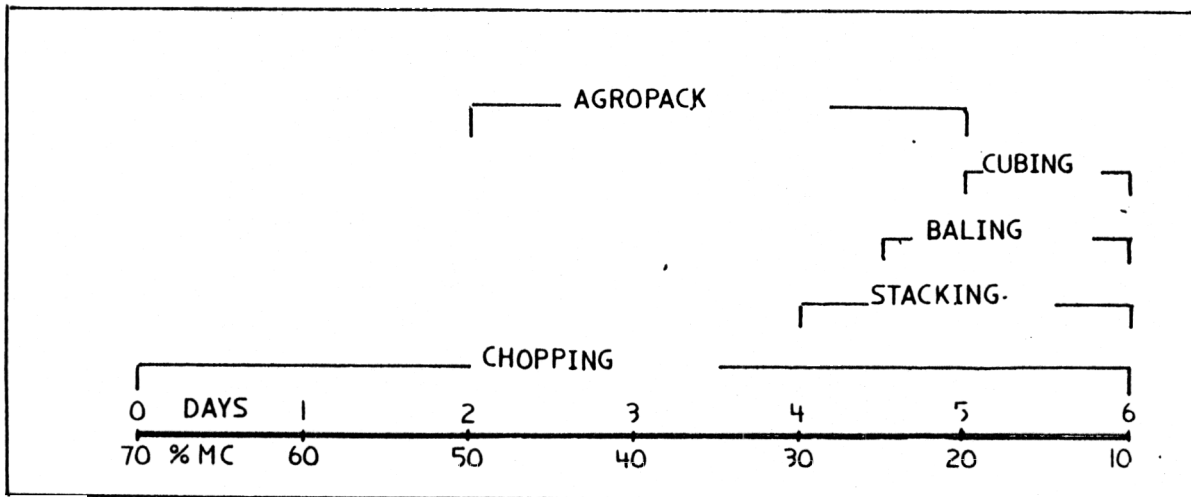


FIGURE 1.

The very basic concept of the rolling-compressing process was based on the natural tendency of most forage crops to wrap tight around rotating shafts.

In its simplest form, the mechanism of the rolling-compressing machine consists of four power driven rotating rollers, which are arranged to confine a channel, where under the compressing action of the rollers the rotation of the hay core can be maintained, and with the introduction of additional hay, new layers are wrapped around the existing core, gradually building up its density.

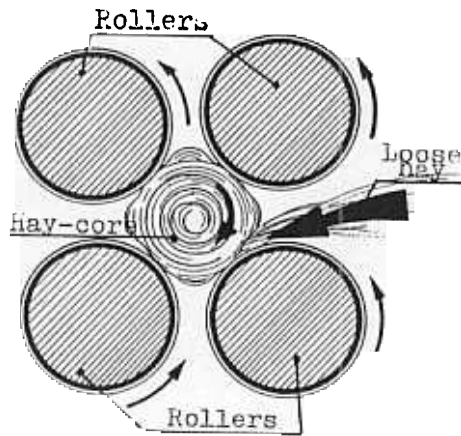


FIGURE 2

To make this process a continuous operation, means had to be developed to discharge the finished core at a rate, which can be synchronized to the rate of intake. Also a cutting mechanism was developed to cut the continuous hay-core into the desired length rolls.

The AGROPACK field machine, shown on the photo below, consists of a pickup, the compacting mechanism with the cutter, and a conveyor elevator to deliver the finished rolls to a wagon trailed behind the machine. This current model is tractor towed and PTO driven. However, the same basic system can be converted into a self-propelled unit.

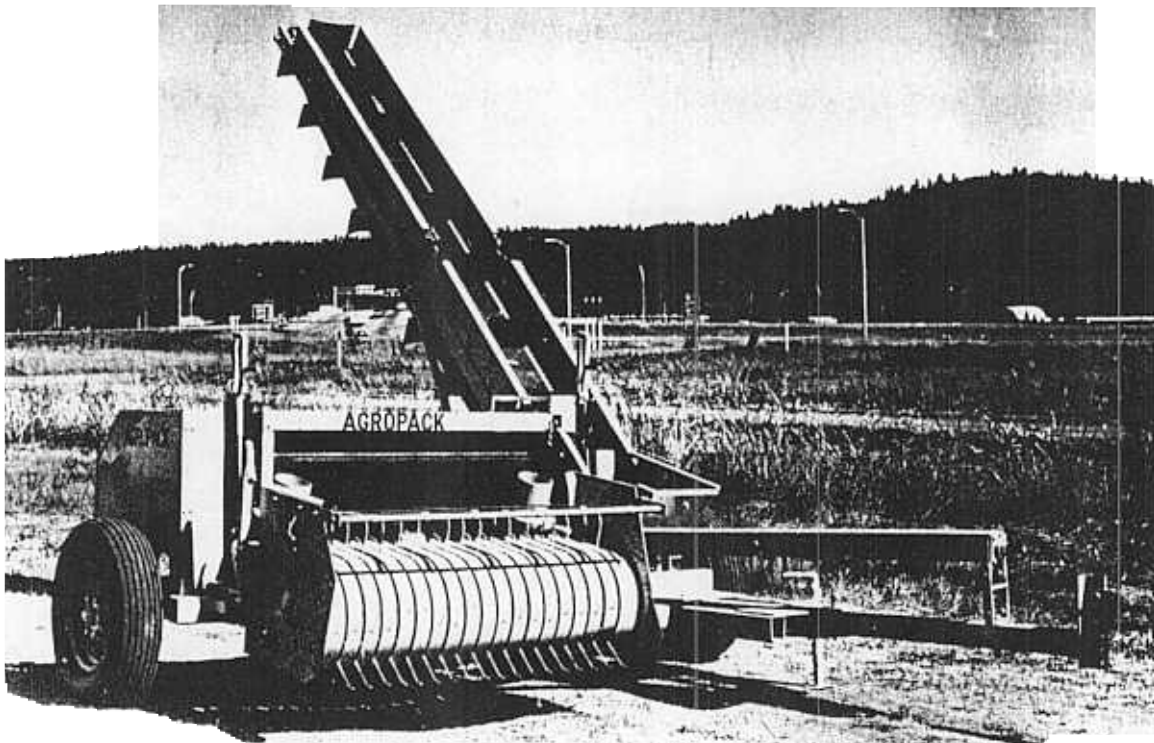


FIGURE 3

The crop is taken from the windrow, and fed into the compression channel, where the self-adjusting roller system completes the compacting process and expells the cut length fin-

ished rolls

Adjustments on the machine are provided to set the minimum and maximum density range of the rolls. Once these adjustments are made the machine automatically responds to any changing conditions, and maintains the set density range.

The cut-length of the rolls can also be pre-selected

The finished rolls are cylindrical, with the diameter ranging from 5 to 7 inches. The variation in diameter is the result of the response of the machine to the rate of intake. The cut-length of the rolls can be selected between 3 to 8 inches, by using the proper chain-drive ratio.

The density range can be adjusted between 20 to about 50 pounds per cubic foot, depending on the condition of the crop. In general the optimum density is between 35 and 45 pounds per cubic foot. To achieve it, relatively small compression force is needed.



FIGURE 4.

The bulk density of the rolls is about 70 per cent of the specific density. Thus the load density may range between 14 and 35 pounds per cubic foot.

During the compacting process the stems retain their original length, thus the rolls are made with long hay. The random interwoven arrangement of the stems, and the overlapping

of the wrapped layers, together with the natural adhesives of the crop provide the structural strength and durability for the rolls, making them adaptable to mechanized bulk handling, such as dumping, conveying or scooping. With minor modifications on the feeding mechanism the rolls can be handled with conventional feed wagons.

For feeding, the rolls can be used in their original form, or can be destroyed in tub-grinder. New equipments are being developed to break up the rolls without substantially reducing the length of the fibers.

Rolls made in the lower density range, less than 40 pounds per cubic foot, can be fed directly, without prior treatment. The animals unroll the hay-layers without any difficulty. Feeding experiments produced very satisfactory results. Beef and dairy cattle, together with young heifers showed immediate acceptance of the rolls. Rolls made from grass hay were also successfully fed to horses.

At the higher density range, over 40 pound per cubic foot, a destructive treatment may be advisable to reduce the possibility of objectionable wastage, caused by the shaking and throwing of the rolls by the animals as they work on them.

For storing the hay-rolls concrete slab is recommended, with or without rain-proof cover, depending on the climate conditions. In contrast to cubes, the hay-rolls have no tendency to disintegrate under weather conditions. As of this date no substantiating results are available to prove the shedding of rain on piled hay-rolls.

To complete the "system" for the use of the hay-rolls, existing handling and storage methods have to be applied, or new methods have to be developed. This is one of the areas, where considerable pioneering work is needed, and where the experience and know-how of the users of this process will play a major role.

To bring the hay-rolls to stabilized storage safe condition, the application of some dehydrating or drying operation, or the use of chemical preservatives is necessary, unless the crop is packaged at the already storage safe moisture-contents.

For this compacting process the crop must be in a "tough" or "pliable" state, where the stems can stand repeated bending without breaking, and where the natural adhesives can be effective. Such conditions can be provided either by "stem-moisture" or by "dew-moisture". By using "dew-moisture", pliability can be achieved even at lower than 20 per cent moisture contents, which is well within the storage safe level. By using "stem-moisture", field curing time can be reduced substantially, reducing the time between successive cuttings, and resulting in excellent quality feed. Also a reduction in weather risk can be achieved, especially in the humid areas.

The AGROPACK process presents a unique combination of the other hay packaging methods; it uses long-hay, (like in baling), but makes small and high-density packages not requiring wire or twine, (like in cubing). Thus it provides a product, which can satisfy the physiological as well as the physical requirements for efficient operations.

The AGROPACK machine is a simple mechanism, with a rated throughput capacity of 6 to 10 tons per hour, depending on the condition of the crop, and on the skill of the operator. The power requirement is about 6 to 10 horsepower-hour per ton, depending on the desired density of the hay-rolls. For satisfactory operation a tractor with at least 80 PTO horsepower is recommended at 540 PTO RPM. The weight of the field machine is about 4000 pounds, with an overall width of 10 feet.